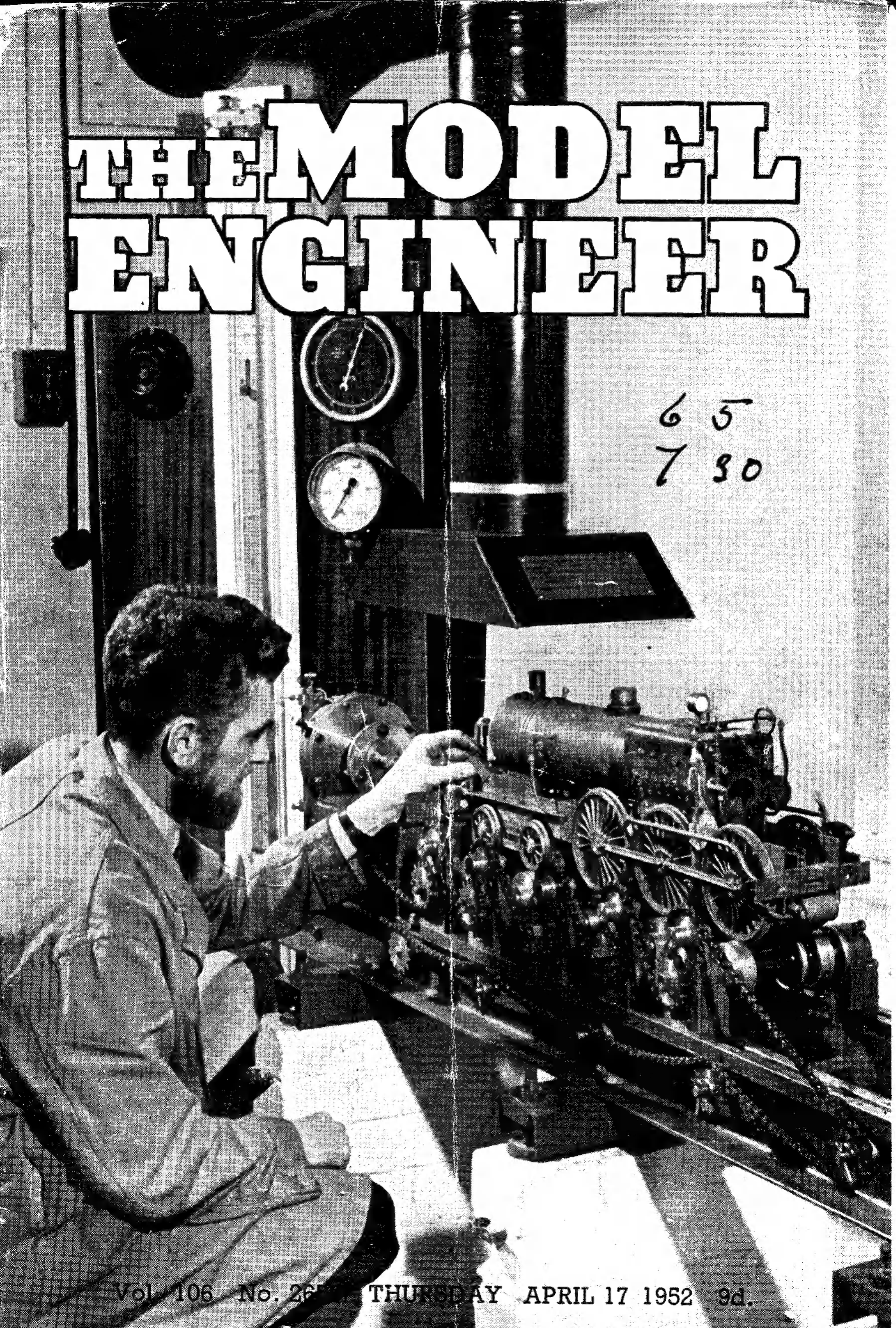
THE MODEL ENGINEER



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The MODEL ENGINEER

PERCIVAL MARSHALL & CO. LTD., 23, GREAT QUEEN ST., LONDON, W.C.2

17TH APRIL 1952 VOL. 106 NO. 2656

IMPORTANT ANNOUNCEMENT

WE call the attention of all readers to the alteration in the dates of this year's MODEL ENGINEER Exhibition, which will now take place at the New Horticultural Hall, Greycoat Street, Westminster, London, S.W.1, from Monday, October 20th till Wednesday, October 29th, and not as previously stated.

We are pleased and proud to be able to announce that the exhibition will be opened on October 20th by His Royal Highness the Duke of Edinburgh, whose interest in the aims and objects of the model engineering hobby is already known to many of our readers.

In the past, the " M.E." Exhibition has been graced by the presence of Royal visitors, and the late King George VI was known to have a considerable interest in model engineering. But this year's " M.E." Exhibition will be the first to be honoured by a Royal opening, and the organisers are taking every possible step to ensure that the show will be a really memorable one. The occasion demands that every effort shall be made by all concerned.

The postponement of the date should help all exhibitors by allowing more time for the preparation of exhibits, and especially for applying those finishing touches which mean so much. The time may seem to be a long way ahead; but it is none too much, and we look forward to the most auspicious of the " M.E." Exhibitions.

SMOKE RINGS

Our Cover Picture

● THE MINIATURE steam locomotive is, without any doubt, the most popular subject for the model builder, but how few of us have any practical knowledge of the effects produced by the size and arrangement of its various components! Most of us are satisfied if our little locomotives do what we regard as a good job of work, and we are not very concerned if its general efficiency is good or bad; so long as our engine's performance is up to our expectations, that is all that matters.

However, in recent years, a growing number of enthusiasts has shown a more enquiring outlook on the subject; these people desire to discover what difference there may be between, say, a superheater-equipped boiler and one of similar size but without a superheater, so far as its consumption of coal and water is concerned. Some difference, of course, is expected, but nobody could say just how much. What is the effect of modifying the dimensions of the boiler, cylinders, valves, ports or grate area?

In full-size practice, there are a few testing plants on which locomotives can be tested so as to give information to augment, or complement that obtained when the locomotives are in normal service. So, in miniature, similar testing plants might be just as useful.

Our cover picture shows the first of these miniature testing plants to be designed and built on something like an official and systematic basis; it is installed at the headquarters of the Society of Model and Experimental Engineers, and from it such data as drawbar pull, fuel consumption, water consumption and tractive force can be obtained by direct observation on locomotives from 2½-in. to 5-in. gauge.

Model Car Association

● WE RECEIVED confirmation recently from Mr. I. W. Moore, hon. secretary of the Model Car Association, that the next delegates' meeting will be held at the York Hotel, Derby, on April 20th. Proceedings will commence at 11 a.m.

It has also been announced that the date of the international meeting at Monza, Italy, has been fixed for July 20th. The hon. secretary will make a further announcement as soon as more specific details become available.

The rules of the Association have now been printed and copies circulated to affiliated clubs. A few extra copies are available for the personal use of members, price 2s. each, and may be obtained from I. W. Moore, 2, Bridge Street, Derby.

S.M.E.E. Secretary

● WE HAVE been advised that Mr. A. B. Storrar has resigned the post of hon. secretary of the Society of Model and Experimental Engineers. He has been succeeded by an old friend of the society and ours: Mr. E. C. Yalden, 31, Longdon Wood, Keston, Kent, to whom all future communications should be sent.

Tees Valley Pumps

● A LETTER recently received from Mr. A. Dixon, hon. secretary of the Northallerton and District Model Engineering Society, mentions a visit to the Tees Valley Pumping Station, Darlington, and gives some particulars of two pairs of old steam pumping engines that are, at present, still in use there.

The larger of the two pairs are twin compound, working at 70 lb. p.s.i.; the stroke is 7 ft., the flywheel 25 ft. in diameter, the main pump slide-rod 36 ft. long and the speed is 12 strokes per min. At approximately 400 gallons of water per stroke, this set of engines pumps some 50 million gallons per week on a coal consumption of six tons per week. We understand that the engineer is allowed three hours per week to make any necessary adjustments, which speaks well for the reliability of these engines.

The smaller pair are more ornate but not quite so well kept as the larger ones. They were built in 1868 by Hawkes, Crawshaw & Co. and run at 12 strokes per min.; they lift 175 gallons per stroke.

It is gratifying to learn that when these engines are replaced by electric pumps, they will not be scrapped, but will be kept as standbys and as show-pieces for all who are interested to see.

A Model Engineering Club for Southend

● MR. A. L. COOPER, hon. secretary of the Southend Model Railway Circle tells us that this club is being re-formed into a model engineering club. Workshop accommodation has been acquired, *for a trial period*, up to June 30th, next; if the scheme proves to be successful, then a more permanent lease of the premises will be taken up.

The management committee of the S.M.R.C. is considering new rules and subscriptions.

Anyone desirous of joining the reconstituted club is invited to apply without delay; it may be too late after June. Mr. Cooper's address is: 14, Sherbourne Gardens, Southend, Essex.

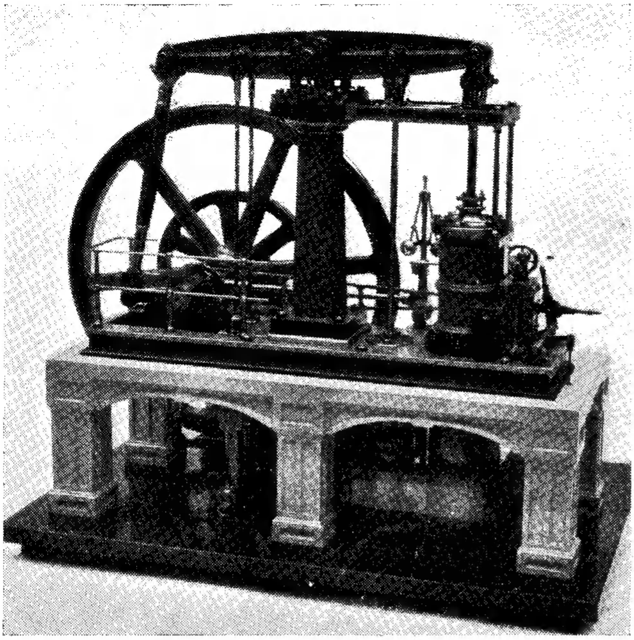
The Last Horse-gin?

● MR. K. BIRKLY, of Sowerby Bridge, has sent us an interesting cutting from the *Halifax Courier and Guardian*; from it we learn that Yorkshire's sole remaining horse-gin—or so it is believed—was due to arrive at Halifax's folk museum at Shibden Hall on March 20th. The gin, gift of the National Coal Board, was being transported from Rothwell on one of Halifax Corporation's special wagons. It is a massive structure, 30 to 40 ft. in length, with a wooden drum 12 ft. in diameter and 3 ft. deep.

Appliances such as these were used in the eighteenth century for hauling coal, the task of the horse being to turn the wheel by walking round the drum. This particular example is thought to be the last one used in this country.

It is to be re-erected in the open at Shibden Hall, under the direction of Mr. Frank Atkinson, Halifax Museums Director.

Northern Models Exhibition

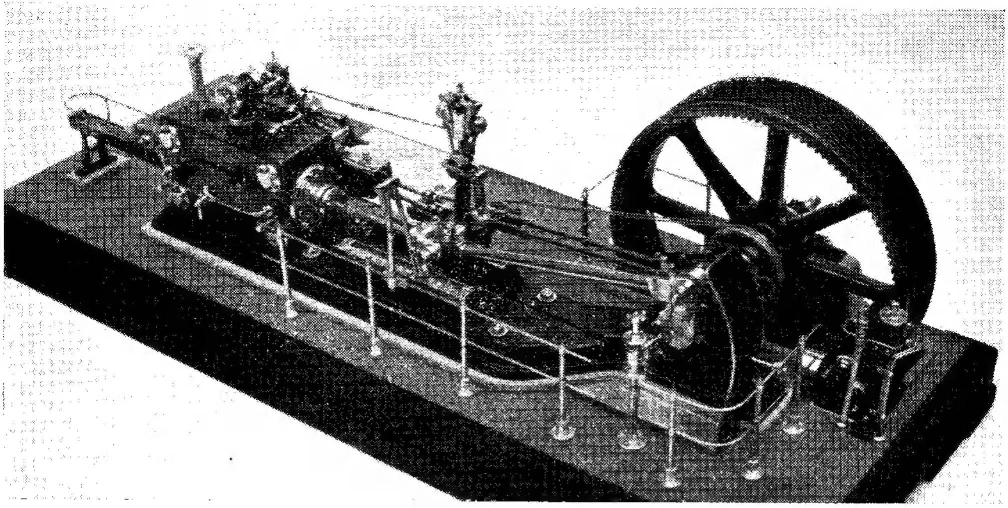


Mr. H. Booth's single-column beam engine

WE were pleased to visit once again the Northern Models Exhibition, organised by the Northern Association of Model Engineers at the Corn and Produce Exchange, Hanging Ditch, Manchester.

It was pleasing to note the high standard of craftsmanship displayed in a great number of the models. In the steam category, there were numerous fine exhibits, including some of particularly high merit in the loan section, by Mr. H. Booth, of Bingley, These included a single-column beam

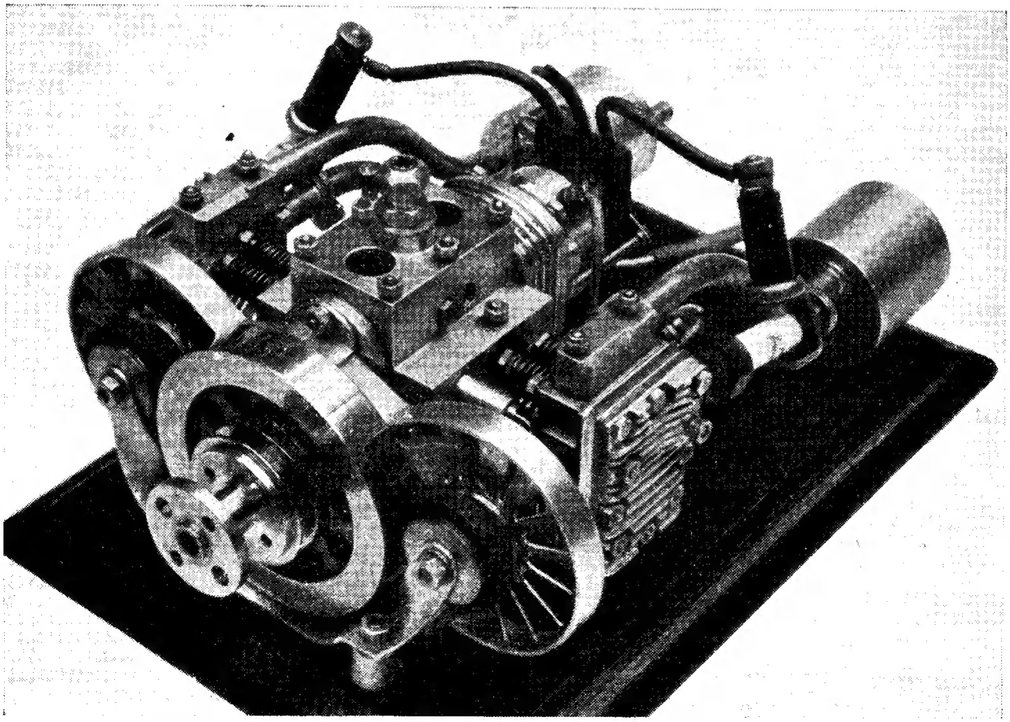
The unfinished galloper roundabout by Mr. H. Slack of Chapel-en-le-Frith



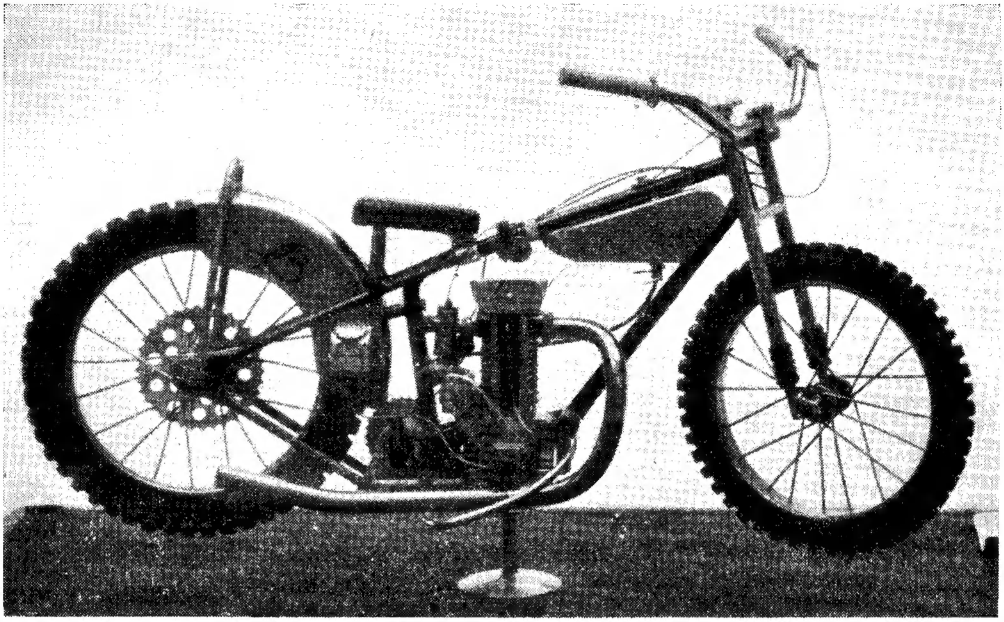
The Corliss-valve horizontal mill engine by Mr. A. Barber

engine, the prototype of which was built in Leeds in 1847; a horizontal compound factory engine from an original built in Bolton about 1870 and re-built by a Bradford firm about 1912; and a simple high-speed factory engine. A number of Mr. Booth's models, forming a collection, were presented to Bingley by Mr. W. H. Smith, and are on view in Bingley Public Library.

The Championship Cup, in Section C, class 18 (scenic and representation models), as well as the Myford Trophy, went to Mr H. Slack's



Mr. C. Brookes's twin-cylinder, horizontally opposed o.h.v. petrol engine

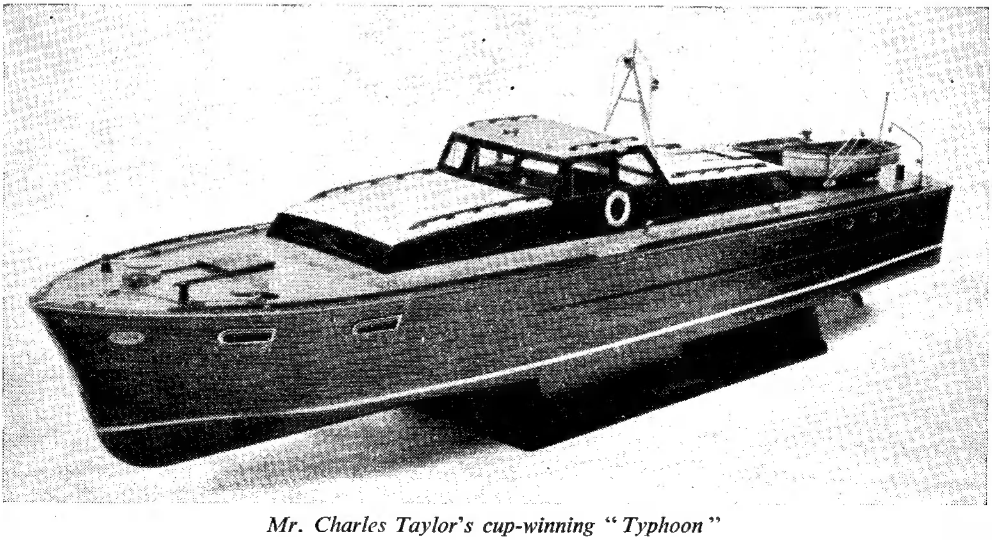


In the International Section, a J.A.P. speedway motorcycle by Mr. C. M. S. Bogendal, of Johanneshov, Sweden

"Galloper" roundabout. As yet unfinished, this model is a really superb piece of craftmanship. Powered by an overtype steam engine, each detail has been meticulously carried out and the shaping of the various parts, including the carving of the horses, bears testimony to many months of careful and highly skilled work. That Mr. Slack is not an engineer by trade, but a leather boot heel manufacturer, makes the results all the more commendable.

In Section C, Class 12, General Models, Mr. R. D. Wood's high pressure steam table engine took the premier award. From a prototype by Murdoch, Aitken & Co. of Glasgow, this model was a most distinctive effort and displayed a thorough knowledge of the subject coupled with ample skill in the use of the various tools employed.

Another nice steam engine was Mr. A. Barber's 1 in. scale horizontal mill engine with Corliss



Mr. Charles Taylor's cup-winning "Typhoon"

valve-gear. Fitted with a grooved flywheel and tail slide, it is truly representative of a great many of this famous type and proved to be a very worthy competitor in this class.

The winner in the I.C. Engine Section, C, Class 13, was an exceedingly neat 14 c.c. twin-cylinder o.h.v. horizontally opposed petrol engine by Mr. W. Ogden of Oldham. This model was complete with exhaust system and silencers, and cooling fans driven by friction wheels off the flywheel periphery. It would appear from the latter, that the engine was intended for marine use.

In Section B, Marine Models, Class 6, (working steam or power boats, displacement type), Mr. Charles Taylor's very handsome ½ in. scale twin-screw cabin cruiser "Typhoon" took the cup. The fine effect of the hull and deck planking made this model as near perfect as we have seen, and many usually neglected fittings were executed with handsome realism.

Through the co-operation of the Swedish journal *Teknik for Alla*, there were several competition entries from Sweden, as well as a collection of work by some of the youngsters of the Hobart Technical School, Tasmania, the latter through the co-operation of the Agent General for Tasmania. In view of the International situation, this was indeed a heroic effort, and one that might well be emulated by other organisers, since it serves to bring together in a friendly bond, model engineers from every part of the world.

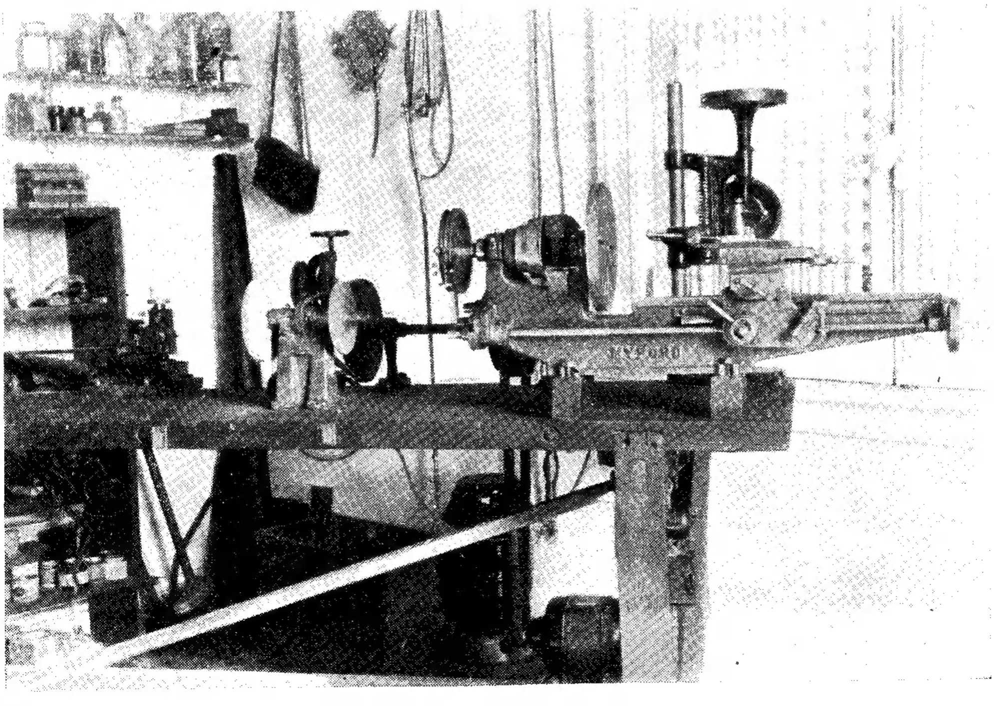
Unfortunately, space does not permit mention of the other excellent exhibits and it should be understood that those already mentioned have been picked at random. Our Northern representative will be covering a number of the models with detailed descriptions and photographic illustrations.

All those who took part in the organisation and presentation of the N.A.M.E. Exhibition are to be congratulated on their work, the results of which we are sure will have been appreciated by everyone who visited the show.

A Modeller's Workshop in Argentina

by H. G. Sharpe

THE photograph reproduced herewith is of my workshop, which is a model of untidiness. Since I purchased the lathe some years ago I have often found the faceplate supplied with it to be quite inadequate, and so, some months ago, I set to and made a pattern and had a casting made, and the faceplate shown in the photograph is the result. There was no difficulty in turning it up, once I had roughed it out on a large lathe to which I have access.



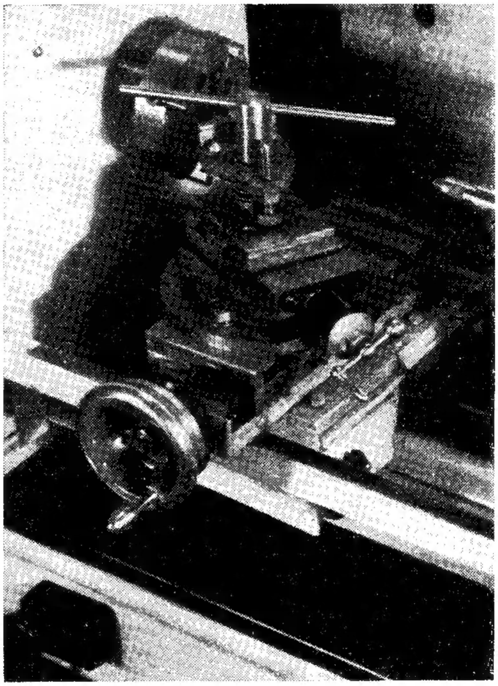
A Home-Made Lathe

Constructed from Goodness Knows What

by Norman Hunter (South Africa)

THIS ridiculous lathe has two advantages. It was fun to make and it works. By all the laws of engineering it has no right to work, but it does.

Before I start explaining the inner horrors of this unlikely engine I feel I owe it to South Africa, where I now live, to say that this lathe is not South Africa's fault. I am an Englishman, I came out here some two years ago and proceeded to return evil for good on the hospitable people who welcomed me here, by constructing this baleful appurtenance in their midst. But I will say this much: I couldn't have done it if it hadn't been for the unlimited tolerance and helpfulness of the ironmongers, tool shops and scrap yards of Johannesburg, whose legitimate business I constantly interrupted, always looking for something they hadn't got, that I could turn into something else.



Top slide swivelled for turning tapers. Candles as well as tapers can be turned, but not matches, as they are square

First I will give you the technical details using all the proper words, which I have learned from various books during the manufacturing process.

Height of centres, 6 in.; Distance between centres, 12 in.; Headstock mandrel $1\frac{1}{4}$ in. bored $\frac{9}{16}$ in.; Tailstock barrel, 1 in.; No. 2 M.T.; Automatic traverse, reversible; Back gear; Swivelling top-slide for taper turning; Speed range 30 r.p.m. to 1,500 r.p.m. (10 speeds).

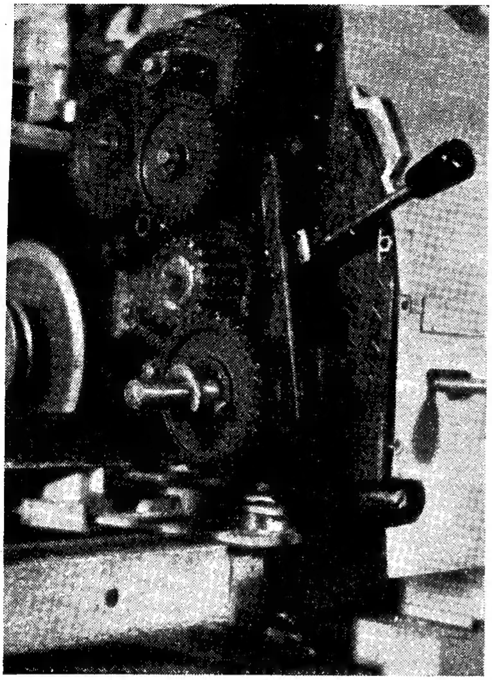
But don't let those reasonable sounding facts delude you into thinking there is anything reasonable about this lathe.

The bed consists of two lengths of angle-iron bolted on top of a length of light railway line (probably from a gold mine), and fastened by heavy angle brackets to a length of steel channel.

The leadscrew and its nut were once part of an extending dining table or something of the sort. The leadscrew is permanently connected to the nut, fixed to the apron. For hand operation the saddle is traversed by means of the hand wheel on the end of the leadscrew. For engaging and disengaging the self-act, in place of the split nut found on self-respecting lathes, I have an absurd clutch arrangement on the headstock. This consists of a short sliding shaft. On one end of this is a gear wheel permanently in mesh with a very thick gear wheel (I bet that's the wrong term for it) on the gear train on the banjo. (Doesn't engineering language sound lovely?) The other end carries a gear wheel which, by moving the shaft to the right, engages with a gear wheel on the leadscrew. Very unsound practice, I'm sure, but it engages or disengages quite comfortably whether the wheels are going round or not, with no expensive noises. In fact, the whole thing purrs quietly like a self-satisfied cat.

You mustn't think that the very select assortment of gears that drive this self-act go whizzing round irrespective of whether the self-act is working or not. My lathe has some principles, though not many. A gear wheel on the spindle meshes with a large wheel just above it, which in turn is meshed with the gear train. A separate little gear wheel on a stalk can be insinuated between these two and so reverse the ultimate movement of the leadscrew. The lever that works this joyful device has a middle position, when the spindle is not connected to any gears at all, and so the lathe spins happily round with the whole of the gear train on holiday.

The headstock mandrel runs in ball-bearings, the forward one being a thrust-bearing. When I was halfway through the job I read that ball-bearings, if not perfectly fitted, are apt to cause



The gearing of the self-act must be seen to be disbelieved

chatter. I refuse to believe that I have fitted those bearings perfectly, but there's no chatter, so what do you know?

The mandrel is threaded 1 in. gas so that when I want faceplates or other detachable jewellery, I can make them with 1 in. gas flanges as the basis. These can be screwed on to the mandrel nose and trued up.

The construction of the tailstock will kill you.

It is a length of 1 in. gas pipe screwed at each end into flanges which are bolted to angle brackets in turn bolted to the baseplate. The 1 in. barrel was machined, bored and the keyway for the stop-it-turning device milled on the lathe, using a temporary tailstock. A threaded rod fixed to the handwheel pushes the barrel in and out without anything sticking out at the back of the wheel. The tailstock locks to the lathe bed by a lever operating an eccentric (appropriate term). Over the whole of this absurd set-up I have drawn a merciful veil of sheet metal. It might have looked better with blanket metal but I couldn't get any.

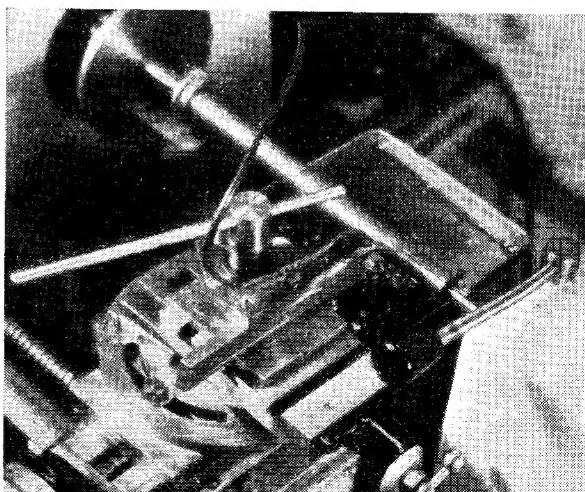
It is, of course, a screwcutting lathe, as you would expect from its screwy appearance. At present it declines to cut threads devised by such people as Mr. Whitworth or Mr. B.S.F. This, as the lathe points out, is not such a drawback as you think, because you often need to cut threads when the exact pitch doesn't matter a row of non-synchronous sprockets. But I shall not let it get away with this ingenious lark for long. As soon as I can get hold of a set of change wheels the lathe will start cutting regular screw threads—and like it. Working out the right wheels for a given thread will probably give me mathematical megrims, but if people will go making funny lathes, what can they expect?

The portion of lathe bed that goes on beyond the headstock serves two purposes. The headstock can be slid along to accommodate jobs larger than will normally go between centres. This, of course, disengages the self-act, but the leadscrew can be hand-operated and, by reversing the job end for end, the whole length can be machined. (The length of the leadscrew was limited by what I could find.) The extra bit of bed is also useful for mounting a polishing head or other contrivance, which can then be driven by the lathe motor, mounted on a sliding carriage running the whole length of the bench.

Now let me boast a bit. The only parts I had done by real engineers were drilling the headstock mandrel, threading the nose and reaming out the taper sockets in mandrel and tailstock barrel. I'd have had a shot at those too, only long drills and taper reamers would have cost me more than I paid to have the job done properly.

The top-slide is a Myford milling slide with the angle base cut off, machined true and bolted to the disc which forms the swivel attachment for taper turning. When I want to do milling, I bolt the whole thing to the upright face of an angle bracket attached to the cross-slide.

The only other ready-made part is the cross-slide hand wheel. I made one of these from a valve wheel but then changed it for a Myford leadscrew handwheel so as to get the micrometer dial. Of course, the figures were upside down



Making a 3/32-in. cut on mild- (and inoffensive) steel, with self-act and self-lubricator in action

for my purpose so I turned them off and re-stamped them with letter punches.

I started the whole job with a small drilling and grinding head, which I afterwards used as a temporary tailstock. In fact, the whole job was a series of temporary set-ups with which I made the final parts. Some of them turned out to be only semi-final parts, as I had to make them yet again. The worst job of the lot was making the cross-slide. This is built up on a slab of $\frac{1}{2}$-in. thick mild-steel and the T-slots are formed by bolting strips of steel on top of lengths of square key steel, then grinding the whole affair up true. Of the eighteen months it took me to complete the lathe very many hours were spent sawing and filing at this cross-slide. The slide runs in square grooves, as I couldn't mill out vee grooves, but there is a jib strip and adjusting screws, and the lathe doesn't seem to mind.

A bar running the length of the bed just below the cross-slide is the slide rest pressure bar. (I don't see why I shouldn't have funny terms of my own.) When I first tried making a cut, the cross-slide see-sawed up and down like a ship in a rough sea, so I fitted this bar (what I really mean is put it on) and everything is now as steady as a rock—probably the logical outcome of a rough sea.

Now this lathe is finished I wonder how I ever managed to make it. Perhaps real engineers feel like that when they see the finished job. In the early stages I used to talk quite confidently about "when the lathe is finished" but I don't think I really believed it ever would be. When I first tried the self-act, I thought "It won't work. You couldn't expect it to. The friction of the gearing plus several things you haven't thought of will use up all the power." I put it in gear and the thing worked. "Ah," I thought, "wait till I try to make a cut, that'll stop it." But it slices a shaving nearly $\frac{1}{8}$ in. thick off mild-steel without any trouble. And only a $\frac{1}{4}$ h.p. motor, too! I still don't really believe it.

As a friend remarked, practically every industry is represented in this lathe; the gear train comes from bits of lawnmower, old hand drills and parts of retired agricultural machinery. In fact, about the only business that has not contributed to this queer construction is the brewing trade, and even that supplies coolant to the operator.

Model Car Association

Rules Governing The National Speed Trophy

Donated by Percival Marshall & Co., Ltd.

(1) The National Speed Trophy is competed for annually, in four separate classes—$1\frac{1}{2}$, $2\frac{1}{2}$, 5 and 10.

(2) The winner in each class retains the Class Trophy for one year. Class winners in each Regional Elimination receive a medal.

(3) Anyone holding a valid affiliation card may compete.

(4) A Regional Elimination event will be held at a track chosen in each region, on a date decided by the M.C.A. committee. All regions *must* hold the Eliminations on the same day.

(5) The clubs chosen to organise the Eliminations are required to send *full* results to the hon. secretary so as to reach him not later than the Wednesday morning following the event. (This rule is necessary, in order that Rules 6 (b) and 6 (c) of these Rules can be implemented.)

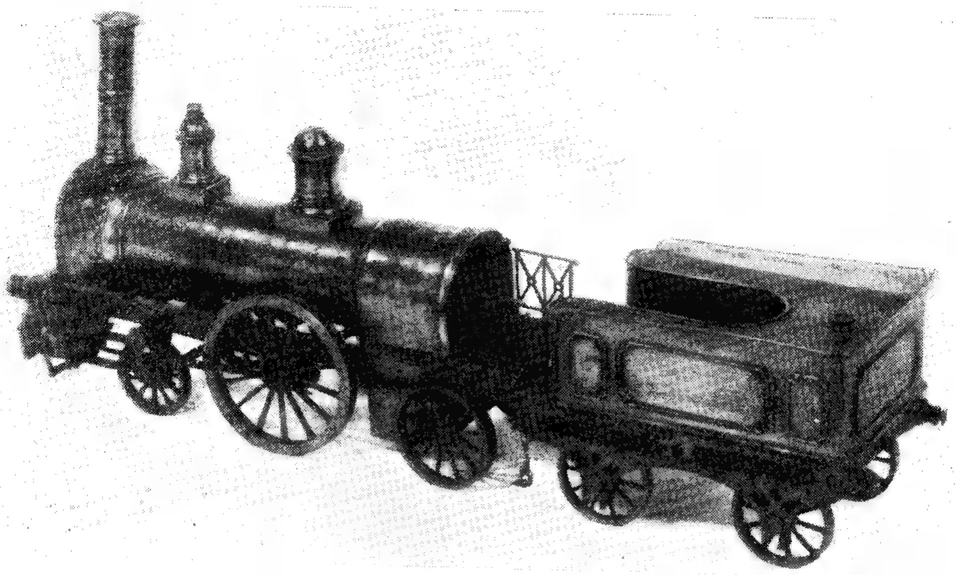
(6) The final will be held on a date and venue decided by the M.C.A. committee, and the following are eligible :—

- (a) The winner of each class in each region, irrespective of winning speed.
- (b) A further number of competitors in each class, to bring the finalists in that class to a total of twelve. The additional competitors will be decided as follows :—After transferring all Regional Class winners to the final, all remaining competitors shown in the regional results will be merged into a table in order of speed, in each class. The appropriate number of extra competitors will then be taken from the top of these lists (e.g., if there are four regional winners in Class 5, these go to the finals, plus the eight next fastest *out of the whole Class 5 entry*.)
- (c) Immediately the hon. secretary has found the names of the additional competitors under Rule 6 (b), he will inform the hon. secretary of the club to which they belong, that they are eligible for the finals and it will be his responsibility to inform the finalists immediately.
- (d) Notwithstanding Rule 6 (b), no competitor shall be allowed to run more than one car in any one class in the finals.
- (e) The same car and engine must be run in the regionals and finals, i.e. the regionals allow a *car* to qualify for the finals and not an individual.

(7) The regionals and finals are both to be run over the $\frac{1}{4}$-mile distance, flying start. The best of two runs to count.

(8) All relevant M.C.A. Competition and Constructional Rules apply.

(9) Arrangements will be made for any car qualifying for the finals to be run by proxy, if required.



An Interesting Old Locomotive Model

Editorial Note:—The following interesting letter and photographs have been received from Mr. G. H. Moysen, publicity manager, Elliott Brothers (London) Ltd., of Lewisham. *Go Ahead* is certainly an interesting little locomotive, and we wonder if, by chance, any reader can give us further information about it.

"In his letter 'That Wonderful Year' (published in your issue dated November 29th, 1951), Mr. E. C. Yalden refers to the illustrations of a beam engine and locomotive made by Watkin and Hill for the Great Exhibition of 1851. As Mr. Yalden says, the business of scientific and optical instrument makers carried on by Watkin and Hill in Charing Cross Road was acquired by Frederick and Charles Elliott shortly after the death of their father in 1852, and amalgamated with the business then known as Elliott & Sons, a business which has continued uninterrupted to the present day and now known as Elliott Brothers (London) Ltd.

"There is still a beautifully made model of a steam engine in the managing director's office at Century Works, the company's present Head Office, but it is not, I am afraid, the model which was illustrated in the Great Exhibition catalogue, though it is quite possible that it was exhibited there. I have made many enquiries about the model, but no one in the present firm can say where it came from.

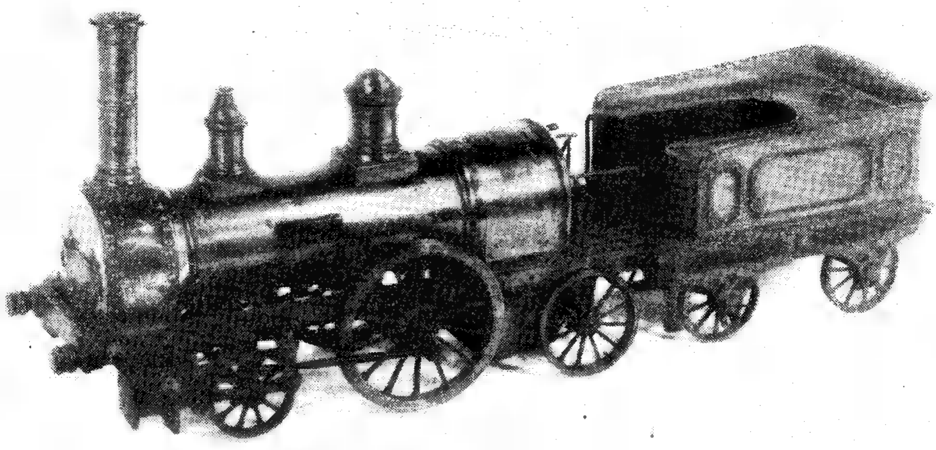
"I have established, however, from Mr. W. Phillips, who joined Elliott Brothers in 1896, and who is still actively engaged with us, that the model was in the possession of the company when he joined over fifty years ago, and even then was regarded as a museum piece. It bears the name-plate 'Go Ahead,' and is still in excellent condition, as the accompanying photographs show. The complete locomotive is 18½ in. long, including the tender and it was obviously made as a working model. The grate and smoke box show signs of carbon deposit, indicating that the boiler was fired in days gone by.

"It is said, that the late Sir Keith Elphinstone, who was an enthusiastic model engineer, and was chairman of Elliott Brothers until his death in 1941, overhauled the 'Go Ahead,' and put it into working order again, but there is no confirmation of this.

"A curious feature of the 'Go Ahead' is that the track of the driving wheels is greater than that of the leading and trailing wheels. None of the wheels is flanged, but it is quite possible that flanges, if originally fitted, were turned off at a later stage to enable the model to stand on a flat surface. On the other hand, the locomotive may have been intended for running on plated tracks between guide rails.

"One cannot but admire the patience and craftsmanship of the workman who made the 'Go Ahead,' about a century ago, remembering that all he had was a hand lathe and a few hand tools, probably of his own make.

"Possibly some of your readers will recognise the photographs and if any further information about the 'Go Ahead' is available we should be most interested to know of it."



A near side view of " Go Ahead "

Drill Grinding Appliances

by W. D. Arnot

FOR the information of those readers who have kindly written me expressing interest in the drill point grinding jig under development (THE MODEL ENGINEER, February 28th, 1952) the requirements of whom I have recorded, and other readers following the subject, I would briefly explain the present position.

The example built from castings has been completed and tested. While a good result can be obtained, there remains, as in all jigs handling very small drills, greater need for delicacy of setting than is desirable, and the sensitivity of feel is not all I hope to make it.

To attempt to simplify setting and manipulation, I have decided to redesign from the knowledge gained. Readers will appreciate that very good fits are imposed when it is realised that absolute concentricity of the drill axis is required. As in an eccentric, the throw error is double that of the error in eccentricity of centres. So, with the drill being ground.

For this reason I have incorporated a good quality chuck, the No. 1A Jacobs, costing about 30s. It has a wide range of capacity ; 0-$\frac{1}{4}$ in., and is a true-running chuck, set in an instant. The interior below the jaws is dead-ended, but I found it soft enough to drill through to allow long drills to be given little overhang.

The length of the chuck body has required that the support should stand farther from the wheel and swing in an arc of greater radius, with consequent larger cam. The slide-ways have been deepened and widened. Despite these modifications and a well-fitted job, by virtue of the considerable distance of the cam thrust centre above the ways, the very slight overturning pressure binds the slide sufficiently to require a stronger return spring than I had hoped to use. That means a loss in sensitivity of feel.

I now propose, in redesign, to provide guide arcs above and below a swinging block through which the chuck spindle will pass, the block to have roller contact with the ways. In this manner there should be no canting action and feel should be much lighter.

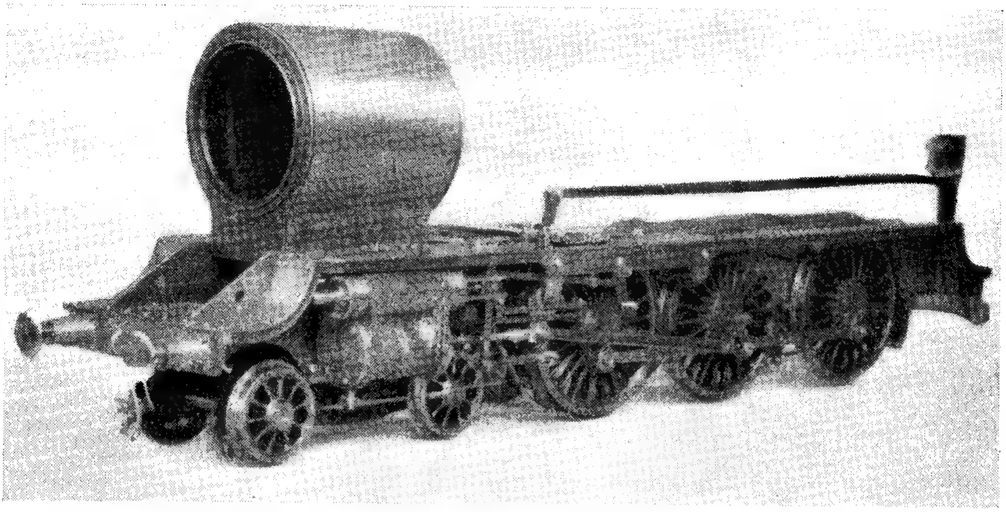
Again, as regards the in-feed for the cut, a long bearing imposes some drag against sensitive feel, and I find that on drills of minute size the grinding contact is so light that no spark is given to caution the operator that pressure is high, consequently the point can be blued with heat inadvertently.

My solution here is short bearing bushes well spaced or a through-bore recessed to leave short bearings, a silky movement is to be aimed at without slack.

I have considered a micrometer feed screw, but doubt any advantage, as it would involve the fine manipulation of too many members at the same time, and feel can do that more speedily and effectively.

A "First Attempt" "On the Way"

by T. Bridgett



THE reproduced photograph shows the chassis of a $3\frac{1}{2}$-in. gauge locomotive that I have under construction. It is a model of the Southern Railway, No. E.850, 4-6-0 type locomotive *Lord Nelson.* and is my first attempt at such work.

It is to Henry Greenly's design. I purchased blueprints, wheel and cylinder castings from them, and the rest of components were made up from bar material or by fabrication.

Work was started by cutting out the main frames from 3 in. $\times$ $\frac{1}{8}$ in. mild-steel strip which were clamped together by five $\frac{1}{8}$-in. $\times$ 40 set-screws, cut out together and filed up to size, so that each was identical.

After doing this, I decided to make the leading bogie truck. Frames were again tackled in the same manner and made up from $\frac{1}{8}$ in. thick mild-steel plate. The main bogie stretcher was fabricated from the same material. The axles were made from $\frac{7}{16}$ in. dia. silver-steel; they only required cutting to length and the ends turning down to receive the wheels. They were, of course, a press-on fit. The horncheeks were now fitted to the frames, and axleboxes were made a nice sliding fit inside the horns, and were then bored out to fit the axles.

Wheels were then turned up to size, axleboxes put on axles, and wheels pressed home. The whole bogie truck was now fitted up complete with spring hangers, springs, life-guards, and all other accessories.

I now carried on with the main frame assembly. All stretchers were made from mild-steel channel section, cut down to required dimensions, these were drilled and tapped $\frac{1}{8}$ in. $\times$ 40 and then the framework was bolted together. The horn-blocks were made from mild-steel bar and duly fitted.

The axleboxes for the coupled wheels were tackled very thoroughly, a gauge bar and tool-maker's buttons being used, and the result obtained was very satisfying and well worth the trouble. The coupled wheels were now turned up; the axles had been made previously, the same method used as for the bogie truck, but this time from $\frac{9}{16}$ in. diameter silver-steel. Axleboxes were put on to axles, wheels correctly quartered and pressed on to axles. Coupling-rods were made from cast-steel plate, bronze bearings were fitted and wheels were then coupled up.

Cylinders are to Greenly double-ported design, and this was my next job. The steamchest liners were made in two halves and a press fit into the cylinder block. Water pressure relief-valves are fitted and taper plug drain-cocks. Motion bracket, girder frame and crosshead guides were made up from bar material.

Valve-gear is made from cast-steel plate, correctly fluted and fitted with bronze bearings. The box-type expansion link was made from a turned and grooved ring cut off to length and case-hardened.

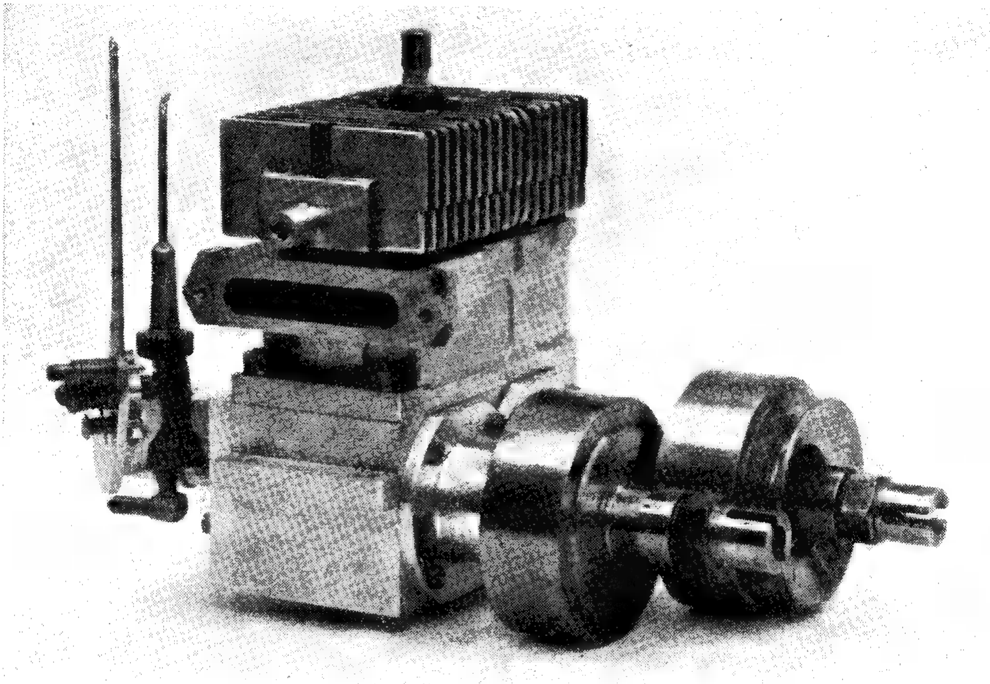
The smokebox was made up from mild-steel and has been brazed up to get a good airtight seal. A mechanical lubricator built to "L.B.S.C." design is fitted under the front end of the smoke-box and is operated from an eccentric on the leading coupled wheel. Steam brakes and sand-boxes are fitted.

All this is a very brief description of what the photograph portrays. I keep a full record of all the work I do on this model, time taken and methods used to do each job and so on. I am indebted to the help that "L.B.S.C." gives in his articles; also to Mr. A. E. Steel of Greenly's, and to a man on the spot, Mr. M. J. Ball, of Cheadle. The photograph was taken by his brother M. W. Ball.

*A Split-Single Two-Stroke Engine

An efficient unit for propelling a class "C" Hydroplane

by R. E. Mitchell



IT will be noted that the plug is offset towards the transfer cylinder. This was done, since in this position the charge is in all probability less diluted with exhaust gases and consequently will be easier to ignite. In order to prevent gas escaping into the ports before the correct opening time due to large clearances between the cylinder wall and piston, the top ring is placed as near to the top of the piston as is thought practical and this same distance is used between the rings. The transfer cylinder piston is machined away for lightening purposes on the inside, since the outside is in contact with the transfer port and crankcase volume is not therefore reduced as in the case of the exhaust piston where the outside of the piston is isolated from the crankcase. In this case the lightening is done on the outside of the piston. Case-hardened hollow gudgeon-pins are used, but they are not fitted with end pads. Previous experience with end pads has shown that they can cause severe scoring of the cylinder bore. Endwise location is secured by means of piano wire pins through holes drilled in both gudgeon-pin and piston. The pins are secured by having their ends bent over at right-angles.

The crankshafts, which are of the usual over-hung type with the crankpins sufficiently long to provide a drive for the inlet valves, are machined from 3 per cent. nickel-steel and are case-hardened on completion. Care had to be exercised in the heat treatment to prevent distortion, since no grinding equipment was available. Lapping of the main journals and crankpin to diameter was the only work carried out on the crankshafts after hardening. The shafts were drilled with the idea of supplying oil, by means of a pump, to the big-ends at a later date.

Complete balancing was not found to be pos-

*Continued from page 475, "M.E.," April 10, 1952.

sible owing to the fact that the periphery of the crank discs has to be complete to receive the synchronising gear teeth. Actually, about one-quarter of the reciprocating weight is balanced instead of the usual half. In passing, complete balancing of the rotary valves was not obtained. The three flat-bottomed holes, drilled nearly through the thickness of the disc and covered by thin discs of brass soldered in, hardly proved been found that flat surfaces provide better bolting faces for additions that are sometimes found necessary in development work of this nature.

The first parts to be tackled were the crankshafts which are shown in Figs. 11 and 12. This was done because it was felt that, with the crude gear-cutting equipment available, the exact centre distance of 1 3/32 in. of the crankshafts

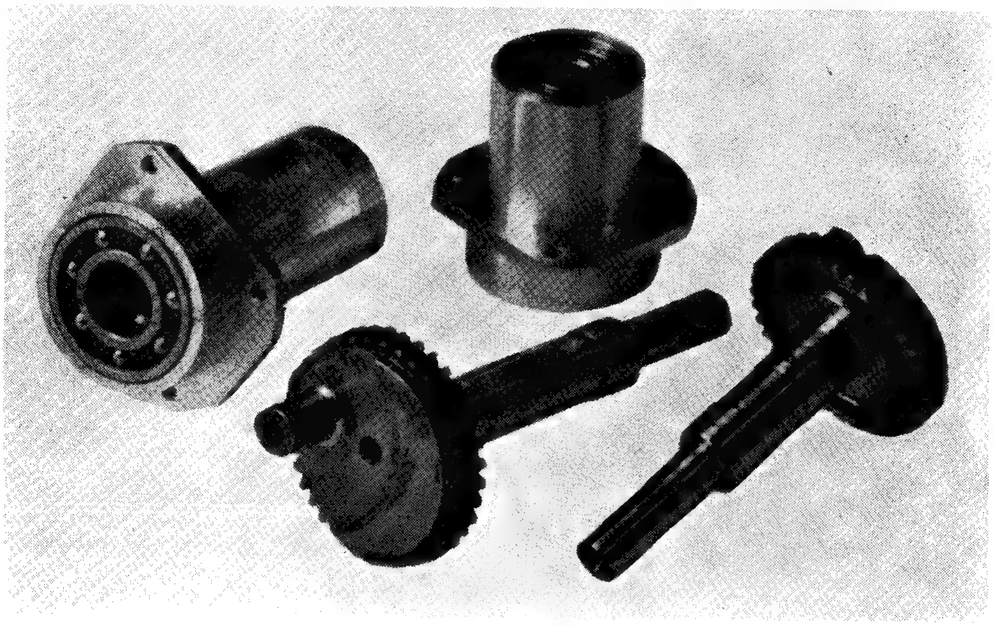


Fig. 11. Crankshafts and main journal housings

sufficient and the peculiar shape of the discs in the vicinity of these holes is the result of filing away metal to obtain as good a balance as possible. Reducing the thickness of the disc opposite to the cut-away portion, at the expense of increased crankcase volume, would, most likely, have been [redacted] better method. The out-of-balance forces here would have been less had aluminium alloy discs been used. These were decided against because trouble, in the form of severe scoring, had previously been encountered when attempting to [redacted] dural on dural. All the light alloy parts, which include the crankcase, front and rear crankcase covers together with the stationary portions of the inlet valves, the port belt, cooling fins, cylinder-head and carburettor, are machined from the solid bar. The material is an aluminium alloy of the duralumin type to B.S.S. 6L1 obtained from Messrs. Rollett, of Liverpool. This material gives [redacted] minimum tensile strength of 24 tons per sq. in. compared with 9 tons per sq. in. for the more usual casting alloy DTD 424. The common fault of porosity with aluminium alloy castings is also avoided and it is doubted whether the making of patterns for one-off jobs is worth while. The angular appearance of the engine could have been avoided but it has could not be guaranteed. Three per cent. nickel case-hardening steel has been used previously for crankshaft construction with excellent results. The bar was gripped in the chuck by the end to be later machined for the crankpin. It was then reduced to 1.14 in. diameter which is the outside diameter of the gear teeth. The journals of $\frac{3}{8}$ in. and $\frac{1}{4}$ in. respectively were then turned 0.001 in. oversize to allow for lapping after case-hardening. A $\frac{1}{16}$ in. radius is provided at the corners to eliminate, as far as possible, subsequent fatigue failure. Sharp corners act as "stress raisers," and fatigue cracks can easily spread from such abrupt changes in cross-sectional area. For a similar reason all highly stressed parts are given as good [redacted] surface finish as possible to eliminate circumferential grooves left by the turning tool. Stub teeth, which have been used for camshaft drive gears in previous four-stroke designs, were decided upon, using 36 teeth. A gear wheel of almost these dimensions was found and [redacted] single point high-speed steel tool was ground, using this wheel as a gauge, making slight modifications [redacted] were thought necessary.

The tool was mounted on its side in the lathe tool holder and the teeth were planed by means of the rack and indexing from a drilled plate

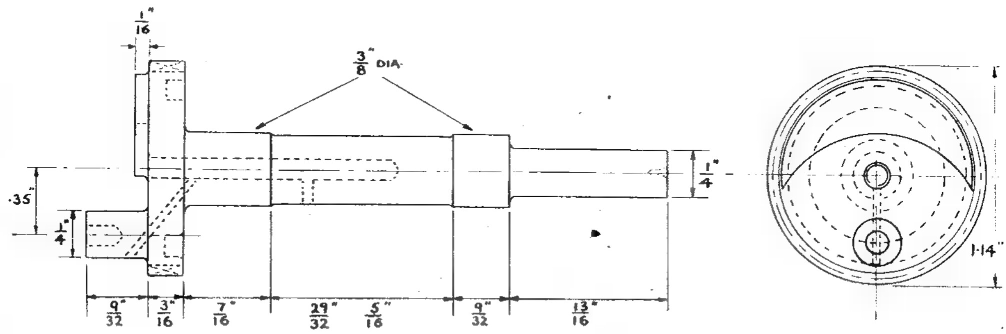


Fig. 12. Details of crankshafts

secured to the end of the lathe mandrel. The teeth were finished to within about 0.002 in. of the correct depth before passing on to the next tooth. The final finishing was done afterwards in one cut without moving the top-slide. The component was then reversed and the 3/8 in. diameter portion was centred by inserting in a hole of the correct size bored through a piece of 1/2 in. diameter brass rod gripped in the three-jaw chuck, and the chuck key was given an extra turn after inserting the crankshaft. Had collets been available this operation would have been easier. The crankshaft was then drilled 7/64 in. diameter to provide an oil way for big-end lubrication. Also at this setting the portion which had previously gripped in the chuck was machined true. The actual diameter here is not important provided that it is larger than the engine stroke plus the crankpin diameter. At this stage, two 3/8 in. diameter holes were bored in a block of brass at the correct centre distance intended for the crankshafts. This was carried out in the vertical slide using the cross-slide index to obtain the required centre distance. From this it was found that the gears worked together satisfactorily, although the back lash was rather more than could have been desired.

To machine the crankpins and balance weights the components were mounted in turn on a Keats vee-angle plate secured to the lathe faceplate. Great care has been taken to obtain the correct orientation between the gear teeth and the crankpin to obtain the designed 10 deg. lead of the exhaust piston. The correct eccentricity to give

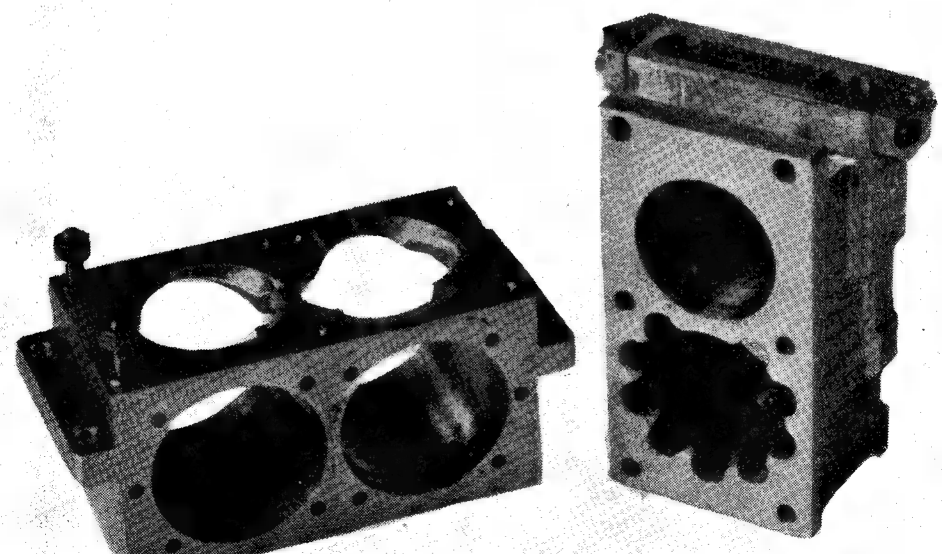


Fig. 13. Crankcase and port belt

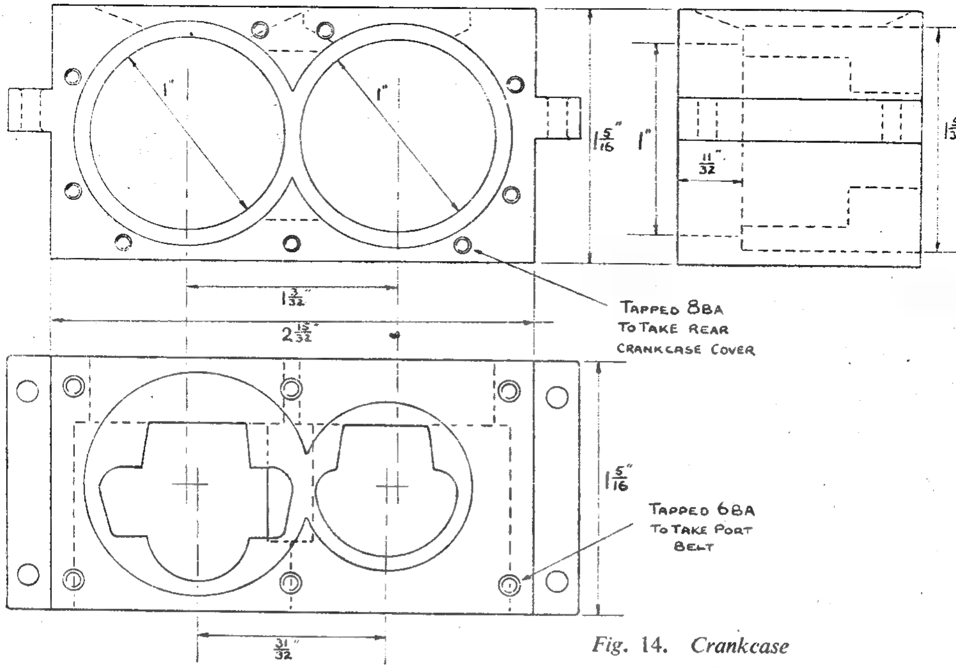


Fig. 14. *Crankcase*

a stroke of 0.700 in. was measured by means of a dial gauge. The crankpin, which is $\frac{1}{4}$ in. diameter, was a straightforward job but owing to the intermittent nature of the cuts, for the most part, these were only light to avoid the risk of the crankshaft turning in the vee of the angle-plate. A $\frac{1}{16}$ in. radius was left where the crankpin joins the crank disc and a 7/64 in. diameter drilled up the centre to a depth equal to the length required to drive the rotary valve. A hole of 1/32 in. diameter was drilled diagonally through the crankpin and crank disc to connect with the central 7/64 in. diameter hole. After the machining had been completed the crankshafts were pack carburised at 920 deg. C. to give a total case depth of 0.010 in. Experiments were first carried out to determine the length of time required, because too great a depth results in the whole tooth section being hard and, consequently, brittle. Experience of this had been obtained previously when the pinion driving the camshaft of a four-stroke shed its teeth very early in its career. Hardening was carried out by quenching in oil from 800 deg. C. from an electric muffle. A light temper for half an hour at 150 deg. C. in an oil bath completed the heat treatment. The diameters were then finally lapped to size using a split external lap of aluminium held in a die holder. The journals were made a fairly tight fit in the bores of the ball races.

The next part to be tackled was the crankcase, which is shown in Figs. 13 and 14, having decided that the designed centre distance of the crankshafts has been adhered to. It was roughed out by sawing from 2 in. sq. duralumin bar.

The length was made equal to the width of the crankcase over the holding-down lugs plus about $\frac{3}{8}$ in. The block was then machined all over except for the ends, making the faces as flat and square as possible. Four holes were drilled and tapped 4 B.A., one at each corner of one of the faces. The reason for this was to secure the block to a piece of 2 in. × $\frac{1}{2}$ in. ground mild-steel bar which was, in turn, bolted to the faceplate. Four similar holes were drilled in one of the adjacent faces, to enable the block to be turned through a right angle. This enabled the use of an angle-plate to be dispensed with since they are rather clumsy when used on a small lathe. The $\frac{3}{8}$ in. extra length of the block accommodates the tapped holes which are cut away when finally machining the ends of the crankcase. The two bores to take the main bearing housings were bored in the lathe with the work on the faceplate, being set over by the correct amount for the second bore. It will be noted that the larger holes bored in the crankcase overlap.

This is necessary to accommodate the synchronising gears and to provide communication between the two portions. Owing to this overlap the crankshafts have to be removed from their housings before these are removed from the crankcase. In the more usual design the housing with crankshaft *in situ* can be removed from the crankcase. No further facing up of the external surfaces was attempted. Using the other set of tapped holes, the crankcase was turned through 90 deg. and the holes to receive the bottom ends of the cylinder liners were similarly bored. The centre distance in this case being 31/32 in. At this stage the clearances for the connecting-rods were milled. The holding-down lugs were formed on the ends of the crankcase by milling with the work held in the vertical slide.

(*To be continued*)

IN THE WORKSHOP

by "Duplex"

No. 113—*The Lever Feed Tailstock

THE clamp, Part 1, is made from a piece of mild-steel that is bored to fit the machined end of the tailstock casting firmly. For this purpose the work is first marked out and is then set up in the four-jaw independent chuck. After the bore has been completed, the hole for the clamp-bolt is drilled. Perhaps the easiest way to carry out this part of the work is to catch the component under the top-slide tool clamp, aligning the work parallel with the chuck face and packing it to centre height. The component may then be centre-drilled, pilot drilled and finally drilled $\frac{1}{4}$ in. diameter to receive the clamp-bolt. The work is next removed from the lathe, and the packing-pieces used to set the component at centre height are carefully preserved, as they will be needed again at a later stage. The part is then cut to shape before again being returned to the lathe for drilling and tapping the 2 B.A. hole and milling the $\frac{3}{16}$ in. slot in the projecting lug.

After the milling operations have been completed, and while the work is still mounted on the top-slide, the $\frac{3}{16}$ in. diameter hole and the hole for tapping 2 B.A. may be drilled. This method will ensure that the holes are square with the milled slot.

*Continued from page 448, "M.E.," April 3, 1952.

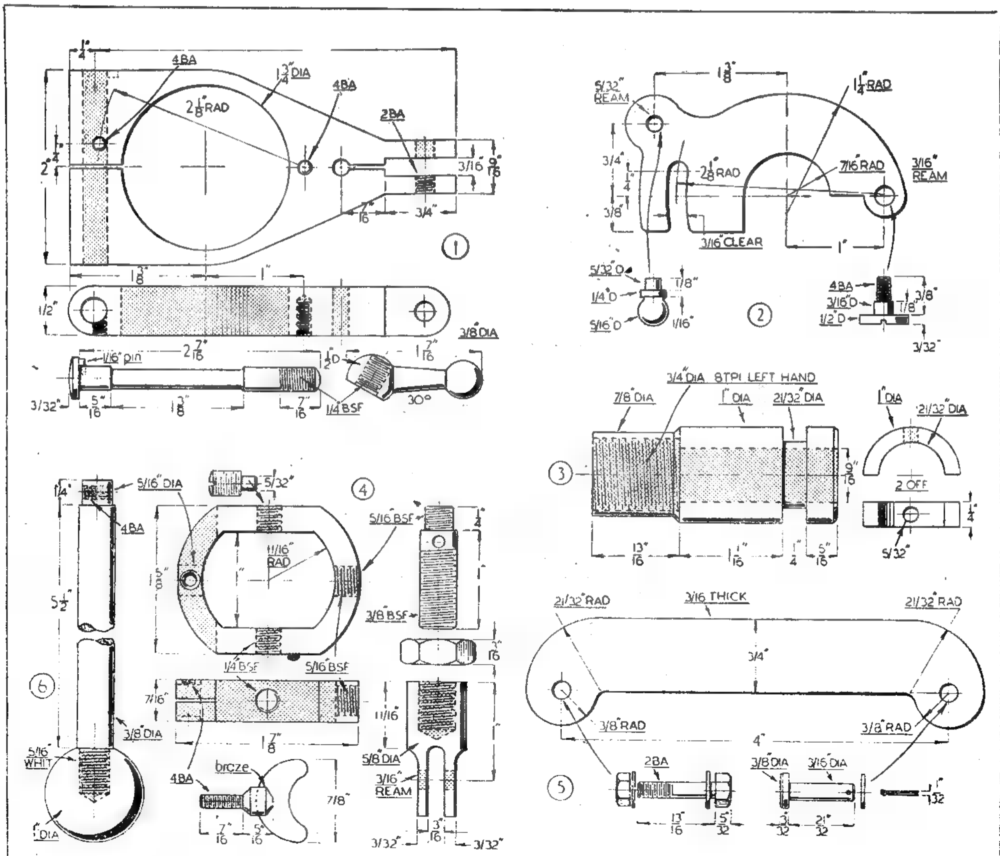


Fig. 8. Working drawings of the various components

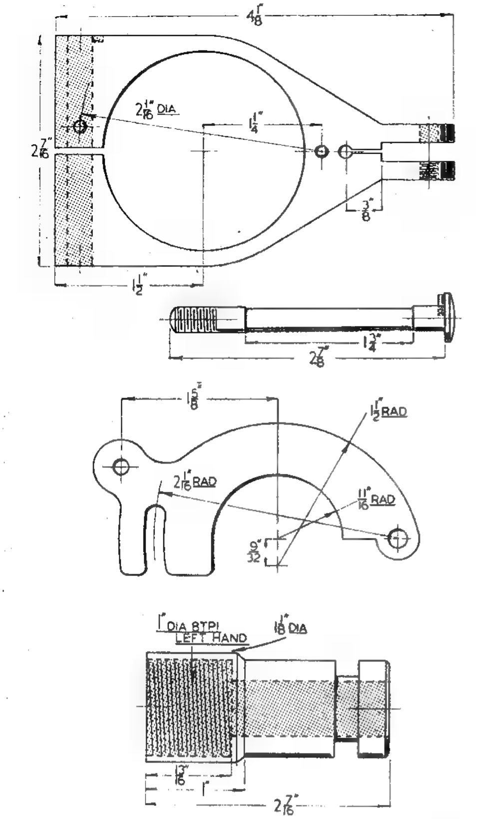


Fig. 9. Drawings of the parts requiring modification when the attachment is applied to the Myford ML7 lathe

The Latch. Part 2. Little need be said in relation to this part, for the work involved is of a kind that is familiar to readers. The small knob used for lifting the latch is made a press fit and may, also, if needed, be riveted in place. For this purpose the 5/32 in. diameter spigot should be increased to 5/32 in. in. length.

The Adapter. Part 3. This part is, preferably, made from brass, as the cutting of the $\frac{3}{4}$ in. diameter left-hand thread will be an easier operation if this material is used. The $\frac{9}{16}$-in. bored hole that passes through the adapter is intended to receive the driving unit of a tailstock drilling spindle that will be described in a later article. The two steel segments seen at the right of the detail drawing are made a working fit in the $\frac{1}{4}$ in. wide slot seen in the adapter. The segments are made from a piece of steel bar that is machined to form a ring 1 in. diameter having a bore of 21/32 in. The ring is then sawn in half, and the two segments so made are each drilled with a 5/32 in. diameter hole to accommodate the ends of bridle screws seen in the drawings that illustrate the bridle, Part 4.

The Bridle. Part 4. This is made from a piece of mild-steel, that has been filed squarely to form a rectangle $1\frac{7}{8}$ in. by $1\frac{5}{8}$ in. The material is then marked out and the surplus material is removed from the inside of the bridle. This work is best carried out by drilling a series of holes that almost touch each other along the scribed lines forming the boundary of the inside of the part. When the holes have been drilled, a fine saw is used to cut through the connecting metal. The unwanted material may then be removed and the inside of the component filed to shape.

Drilling and Tapping

When this has been done, the work is mounted in the four-jaw independent chuck in order to drill and tap the four holes that accommodate the two bridle screws, the fork stud and the lever. It is best to carry out this work in the chuck so as to ensure that the holes are tapped square. The $\frac{5}{16}$ in. diameter seating for the lever should be formed with a small boring tool.

As soon as the machining is complete the bridle is finally filed to shape, and a saw cut is made across the end of the lever seating. This saw cut enables the locking-screw fitted to the bridle to clamp the lever. It will be observed that the lever itself is tapped 4 B.A. for half its diameter. If the tapping of both the lever and the bridle is carried out with the two parts clamped together, the locking screw will hold the lever securely. The methods used for milling and drilling the clamp, Part 1, are equally applicable when making the fork attached to the end of the bridle assembly, Part 4. In this instance it is advisable to carry out the milling as the first operation

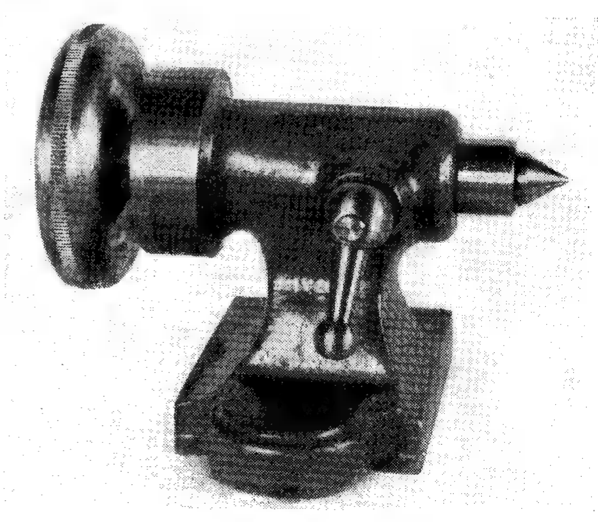


Fig. 10. *Tailstock having an internal working thread*

made upon the fork. For this purpose a piece of round material some four inches long is gripped under the tool-clamp in the top-slide ; the work will then be held securely. The simple turning operations are carried out after the milling has been completed.

The link, Part 5 and the lever, Part 6 require no detailed comment.

Lever Feed Tailstock for the Myford ML7 Lathe

The lever attachment described above can also be used with the Myford ML7 lathe. Naturally, certain of the parts need some modification ; but this relates to dimensions only, and these are shown in Fig. 9 that illustrates those components requiring alteration. These drawings must be read in conjunction with those in Fig. 8 that relate to similar parts. In Fig. 9 only those measurements that need modification are given ; the remaining informatjon will be found in the previous set of drawings.

Hand Lever Attachments That May be Constructed in the Small Workshop

2. *Attachments for Tailstocks Having an Internal Working Thread.* The conversion of the type of tailstock illustrated in Fig. 10 and, in section, in Fig. 1B, is a somewhat more difficult matter ; moreover, it is not possible to arrange matters so that the tailstock barrel can be moved either by the handwheel or by means of

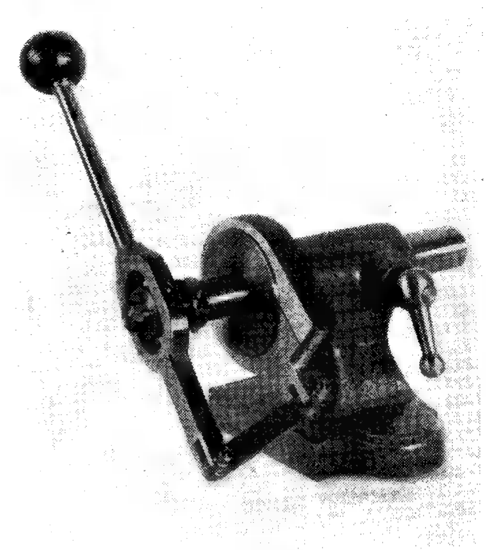


Fig. 12. The complete attachment for converting the tailstock to lever feed

the lever at will. The user will, therefore, have to content himself with providing lever operation only.

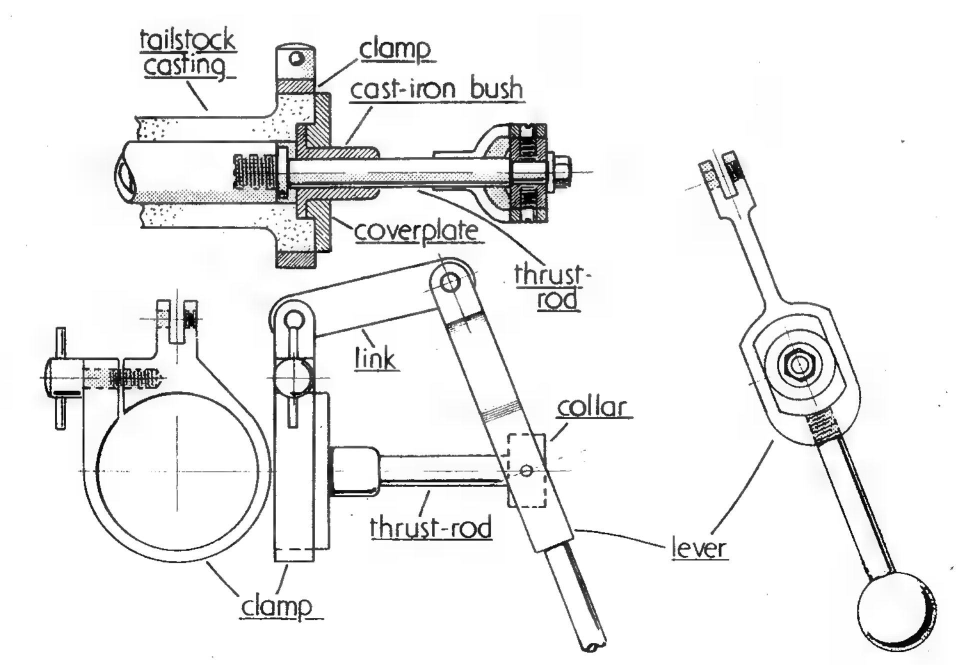


Fig. 11. Method of adapting the tailstock illustrated in Fig. 10 for handlever operation

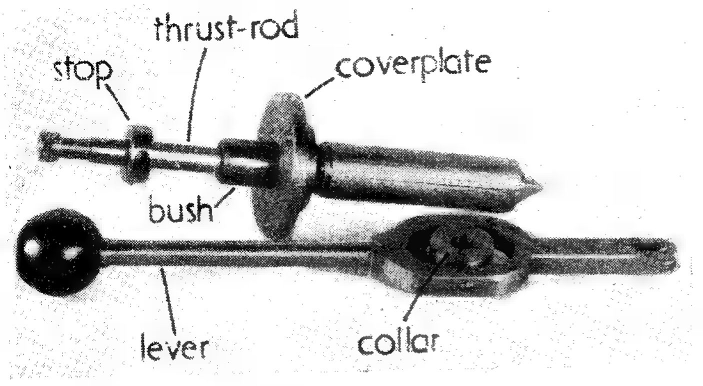


Fig. 13. *The parts of the attachment*

The handwheel and feedscrew seen in the illustrations are removed and replaced by a thrust-rod and cast-iron bush, as depicted in Fig. 11. The thrust-rod screws into the barrel of the tailstock and is moved by means of a lever acting on a collar attached to the thrust end. The collar is free to turn on the rod ; so by loosening the clamp on the tailstock casting, the lever may be set in any desired position around the axis of the tailstock. The complete tailstock is illustrated in Fig. 12. If desired, the T-handled locking-screw for the clamp, shown in the sectional drawing Fig. 11, may be replaced by an Allen cap-screw, as seen in the illustrations of the complete tailstock. This arrangement has the advantage of providing a locking-screw that does not project above the surface of the clamp.

It is not proposed to give detailed drawings of the fitment here. Those readers who wish to apply the device to their own lathes will no doubt find that a number of small modifications are needed to meet individual requirements However, if the principles shown in the illustrations are followed, successful results will be obtained.

A Useful Stop

When using a lever feed tailstock it will be found that a stop to limit the travel of the tailstock barrel is an advantage. This stop is easily fitted to the type of tailstock now being discussed, for it takes the form of a simple split collar that may be slid along the thrust-rod and locked in any desired position. By this means, for example, the tailstock travel can be adjusted to enable a number of similar components to be drilled to the same depth.

The form of collar suitable for the purpose is illustrated in the general arrangement drawing and may also be seen in the illustrations of the complete tailstock. The making of these collars has been described many times in the past, so requires no further comment now.

The conversion, to lever operation, of tailstocks fitted to precision lathes such as the Boley, though practicable, is, perhaps, inadvisable. Makers of precision lathes do not sell conversion attachments ; they supply complete interchangeable tailstocks only.

For those who do not need a lever feed attachment that can be adjusted and swung around the axis of the tailstock, the simplified device illustrated in Fig. 14 may suffice.

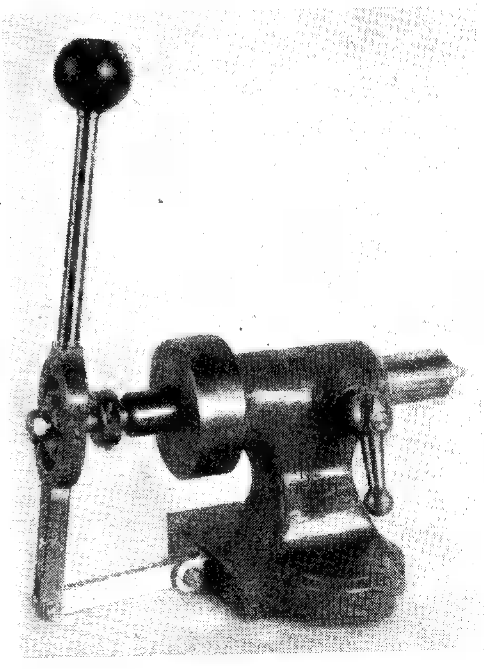


Fig. 14. *Simplified lever-operated tailstock*

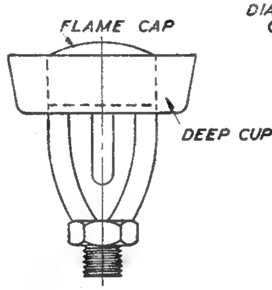
As will be seen, the clamp is discarded and the anchorage for the link is a fork that screws into the base of tailstock casting. Apart from this alteration the parts of the attachment are the same as those previously illustrated.

In making the attachment it is advisable to lap both the thrust-rod and the cast-iron bush ; in this way the movement of the parts will be made smooth.

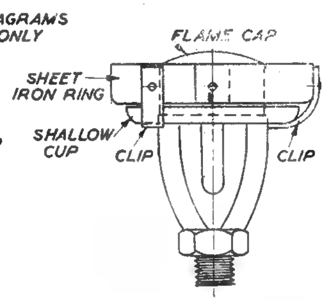
"L.B.S.C.'s" Lobby Chat

More Miscellany

BEFORE getting down to business this week, just a word to new readers, and others whom it may concern. If you have any queries on subjects other than those directly appertaining to steam locomotives, and their building, operating, and maintenance, do, *please*, address them to the writers in this journal who specialise in whatever particular branch you are interested in. While I appreciate the confidence of those who send queries of other kinds, I don't reckon to be a mechanical and electrical cyclopedia. Just one example will suffice. I recently mentioned that I did all the maintenance work to my gasoline buggy; and that promptly brought a cascade of queries on car repairs, maintenance, decarbonising, carburettor and ignition adjustment, and so on. I just haven't the time to dispense individual information. Also—I just hate to have to repeat it—I don't pay the carriage on free information, except in the case of personal friends. There is also one more aspect. A schoolboy recently sent a list of queries relating to a gauge "O" engine he was building to his own ideas, and requested me to give a detailed answer to them "in next week's 'M.E.'"! 'Nuff sed. So much for that; now we'll get on with the job.



Original Swedish Primus burner



How to prevent British burner flooding

Oil Burner Trouble

A new reader recently had the chance of purchasing a commercially-built locomotive at a reasonable figure—something to be mighty thankful for nowadays!—and in fairly good condition, at that; but there were wasps in the jampot. She had a spirit-fired water-tube boiler, and the design of the cylinders and motion were not such as I would specify for a similar type of locomotive. Consequently, he soon found that not only was the engine very expensive to run, but the boiler failed to maintain working pressure. A follower of these notes advised him to fit one of my paraffin burners; but not being much of a mechanic, and lacking the necessary appliances for brazing, he decided to purchase a commercial stove burner. This was a British-made imitation of the Swedish Primus type, having a circular cup, with a dome inside it, which had several rows of perforations around the sides. It fitted the wide firebox casing very nicely; and as our friend had owned a pre-war Primus stove with a burner of similar size, and knew how efficient it was, he naturally thought that all his troubles were over, and there would be plenty of steam.

Alas for his hopes! When lighted and placed in the firebox, it was only a matter of seconds before the burner flooded, creating a glorious flare-up (which delighted his young son, but alarmed his wife) and smothering the engine with greasy soot. Even the use of an auxiliary blower wouldn't make the burner behave. In despair, our friend tried the burner in the open air, and found that whilst it would work with low pressure and a small flame, it wasn't in the same street with his old Primus, and flooded at far below the ordinary working pressure of the latter.

Easy Remedy

As soon as I read in his letter, that the burner was made by a certain firm in Birmingham, I knew what the trouble was, having purchased one myself, to replace the worn-out Primus burner on one of our domestic stoves. I couldn't obtain a genuine Primus burner at the time; but thanks to my Swedish friend, Mr. A. Ohlin, I now have one. The Primus burners have a very deep cup, almost as high as the dome; and the flames from the perforations impinge on this, keeping it redhot, and maintaining the vaporiser at working temperature, even with a very high pressure in the tank. On the other hand, the cup on the British imitation is little more than a saucer. When the tank is pumped up, the flame blows right over the edge of the saucer, which never gets anywhere near hot enough to transfer sufficient heat to the vaporiser. The latter being unable to deal with the increased flow of oil, raw oil spurts from the nipple, and the conflagration immediately starts.

I cured my burner of its antics in five minutes, by cutting a strip of 18-gauge sheet iron and bending it into a circle of the same diameter as the top of the saucer. A single rivet was put through the joint, and three tags riveted on. The ring was placed on top of the saucer, and the tags bent underneath, to prevent it slipping off. That did the trick right away. As the ring is as high as the dome ("flame cap" is the official title) the flames blow straight on to it, and maintain it at bright red, the heat keeping the vaporiser at proper temperature. No matter how high

the tank pressure is, within reason, the burner never floods, and the "thermal efficiency" (very posh, that!) of the burner is equal to the old Primus. I told our friend what to do, and he did it, using a bit of a stout tin canister for a ring. The flame now blows straight on to the bottom of the inside barrel of the water-tube boiler, and makes as much steam as the inefficient cylinders and motion can waste; but our friend says that it makes his arm ache, continually operating the hand pump! In passing, I notice that the original makers of the engine, now list a paraffin burner which is a copy of one of my earlier type; no acknowledgment, of course!

Signal Query

Several readers who are thinking of installing automatic signalling on their little lines, after the pattern of my own outfit, in order to make the operation more realistic, have asked how my installation stood up to the wet winter, and whether the working was affected. I've only had one trouble, which didn't matter a bean. Owing to the magnetic switch which operates the air-valve on the full-sized L.B. & S.C.R. signal being also full-size, and operating on 12 V, and the fact that the relays are also 12 V, naturally I operate with a 12-V battery, but the trouble arises from the fact that there is a whole heap of difference between the spacing of the full-size rails and my little rails. Whereas a 12-V current hasn't enough energy to travel over 4 ft. $8\frac{1}{2}$ in. of wet sleeper, it manages to get over $3\frac{1}{2}$ in. of wet sleeper all right. The trickle of "juice" isn't sufficient to actuate the relays; but if a train enters a section and puts the signals behind it to the "on" position, enough current leaks across the wet sleepers, to hold the relay up, and so the signals don't come "off" again when the train has passed out of section. That ought to please Inspector Meticulous, anyway—a fault putting the signals to danger—which is perfectly safe, says Pat!

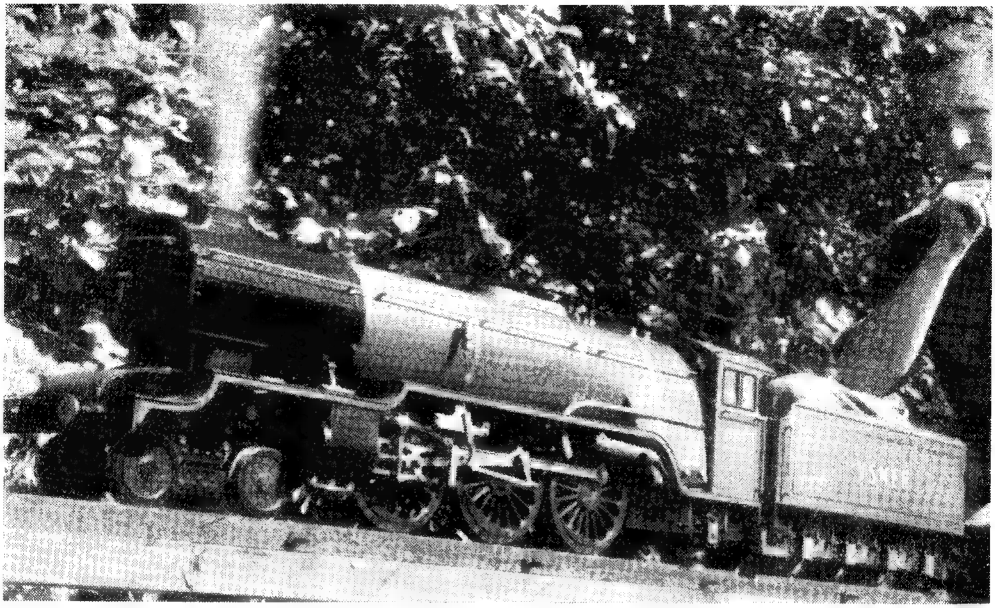
However, this state of things only occurs when it is actually "raining cats and dogs" or just after. The sleepers have to be *really* wet, for current to leak across; and as soon as the down-pour ceases, and the water runs off the sleepers, which doesn't take very long, the relays resume business as usual. A shower, or light rain, has no appreciable effect; yesterday afternoon, time of writing, I went out to test a small repair that I had made to one of my engines. Just after she got up steam, Jupiter Pluvius thought he would spoil the show, but he didn't! I just threw a cover over the portable motor and compressor that supplies air to work the big signal, and carried on. The shower lasted ten minutes or so, but the signals worked all right. Naturally, I shouldn't go out and start operations in a continuous heavy downpour—I may be old, but I'm not *that* silly!—so the temporary interruption of the signalling system makes no difference. Only a few feet of wiring is exposed, and that is lead-covered; the rest is underneath the longitudinals, and therefore protected, as are the wires inside the iron-pipe signal-posts. The relays are in creosoted-wood boxes under the longitudinals, and each has a thin sheet-brass inverted tray over it, so that all water runs off. The solenoids on the little semaphore upper-quadrant signal are in brass cases, with a tube on top where the rod emerges, and a deep thimble over it, which prevents any water getting in. The colour-lights are in waterproof cases. As the old Brighton signal didn't catch a cold all the 45 years it did duty at Coulsdon Station, it isn't likely to get either flu or rheumatics in its present position. Strange as it may seem, the old peg actually works a jolly sight harder now, than ever it did at Coulsdon; for when I'm running a fast passenger engine, or my few personal friends are running, it operates on an average, every forty seconds. It can't be a member of the Amalgamated Union of Railway Signals, for it has never asked for a wage increase for the extra work, nor ever threatened to go on strike! The long-burning lamp is always alight, as it was in L.B. & S.C.R. and Southern days; I keep it going, as a matter of sentiment. The amount of paraffin used, is negligible; less than a pint per week. When the lamp ceases to shine down the little line at night, Curly will have left this earth.

There is, of course, a simple way to get over the one solitary difficulty of current leakage, viz.: use of a very low voltage, say 2 V, for the track circuits, with relays wound to operate on that voltage, and let them cut-in the 12-V circuit to operate the lights and the magnetic air-valve. This would entail extra wiring, and altering the relays, and isn't worth the trouble involved. In the simple circuits I gave, for operating lights or solenoids direct, without any relays, wet sleepers would have no effect whatever, as the leakage of current would be insufficient to light a lamp or work a solenoid.

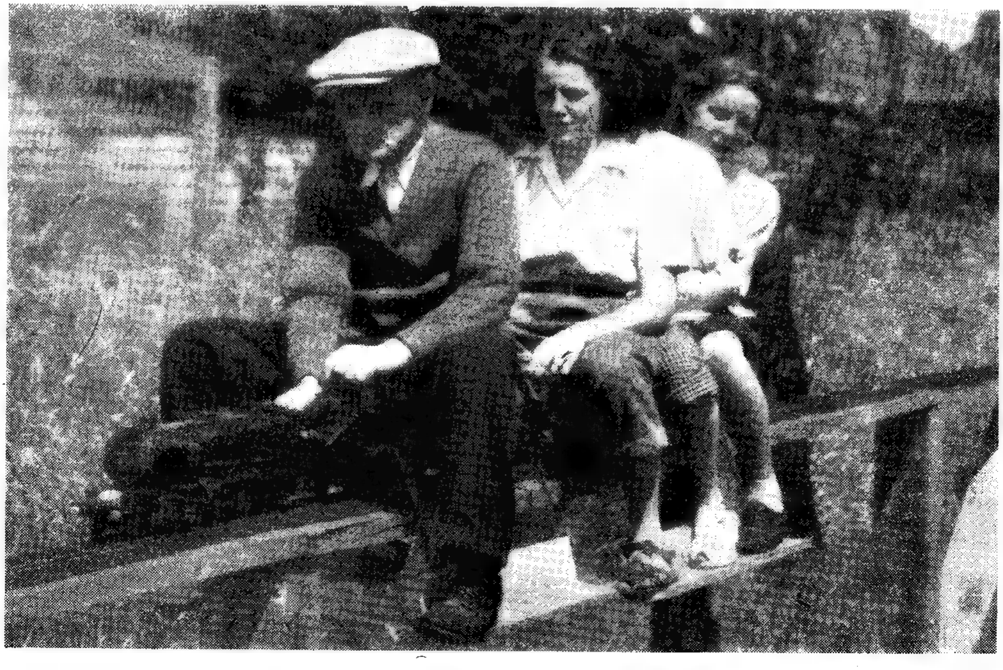
Use Your Noddle!

I've often thought, when going through a batch of correspondence, what a vast amount of time, energy, ink, and paper could easily be saved if the querist tackled his difficulty in a Sherlock-Holmes-like manner, before seeking information. This applies especially to good folk who are living in places far remote from the locality in which dwells your humble servant. We used to learn at school, in my time at any rate, that every effect has a cause; and that the cause can be discovered, either by deduction or elimination. That sounds a bit "third programmish," but you get my meaning. A kiddy once brought to me, a faulty clockwork toy, with the remark that "Somefin's gorn wrong wiv it, or somefin ain't just right." The boy didn't know enough about the mechanism of the toy to try and ascertain the trouble, but there are querists who virtually emulate that kiddy, whilst possessing sufficient knowledge to solve their own problem.

To quote an example; not so long ago, I received a letter, the writer of which said that he had completed the chassis of a locomotive, to my drawings and instructions. On trying it under air pressure, it wouldn't go. Could I tell him why? There was not the slightest clue; no mention of what happened when air pressure was applied. He didn't say whether the wheels made any attempt to turn, or whether there were any signs of blowing at the exhaust, or elsewhere. I was more "in the dark" than the querist, for



Mr. F. Swinton's " Hielan' Lassie "



" Austere Ada " wins a bet—the stake can be seen in front of the smokebox. Mr. F. Swinton is driving

whilst he had the job under his nose, in a manner of speaking, I couldn't examine it at a distance of over 200 miles. All I could do, was to make two or three brief suggestions ; but an analysis of the actual job would have soon laid bare the fault or faults. The primary factor in the movement of the whole works of any engine, is the piston—or pistons, in an engine with two or more cylinders. It stands to reason that if the piston doesn't move, either there is no pressure on it to cause it to move, or else there is some resistance which is greater than the pressure applied. In the case referred to above, the querist said that the engine was quite free ; therefore pressure on the piston should have moved it. As there was no movement, obviously there was no pressure, although air was being pumped into the steamchest. Where was it going ? There is only one way out, assuming that the glands were packed, and the cover joints were not blowing ; had they been, the escape of air would surely have been heard, and maybe felt, by the operator of the air pump. The way out is via the exhaust port ; and to get to the port, without moving the piston, the air would either have to blow past the valve, or past the piston, or both. Therefore, the refusal of the engine to work, may have been caused by a badly-faced slide-valve, or badly-fitted pistons. Being a first attempt, the trouble was probably a " little bit of each."

Alternatively, air may not have been reaching the pistons at all. I know of several cases where gaskets have been put between flanged joints, without any holes in them, for steam to pass ; and it is quite " on the cards," that the cylinder cover joints may have been blocking the ends of the passageways, where they meet the cylinder bore. The querist referred to, assured me that the valve setting was correct, otherwise I should have suggested that the valve was not uncovering the port, and so preventing air getting to the piston. I remember one case, just after the war, when a querist told me that he had tried for hours to get an engine to turn its wheels on air, and couldn't get a kick out of it. He examined it all over, checked everything he could think of —and finally discovered that the cup leather on his tyre pump had " turned inside out " as the kiddies would say ; on the downstroke, instead of air being forced to the engine, it escaped backwards past the reversed cup leather, and blew out through the vent hole in the barrel. The slight resistance, as the pump was operated,

Mr. R. E. Kitson tests his " King "—the rider is Miss Kitson

the supporting webs of both steps. Use Easyflo for this, and take care not to "unstick" the guard by overheating the first joint! Allow to cool to black; pickle, scrub, and then finish filing to shape. Set out and drill the rivet-holes No. 54, and there we are.

Fixing the Footsteps

When you were drilling the rivet-holes in the left-hand tender-side, I mentioned that only one should be drilled in each place where the footsteps fit. In the case of the upper step, it was one of the end holes.

Tin the riveting faces of the steps, and the places where they are to fit. Then place the tender on the riveting dolly, and put the step in position. Insert a stub of 18-gauge brass wire in the appropriate hole in the step and the one in the tender, and form a head on it with the rivet-set as before. (It will probably be necessary to grind a flat on one side of the set first, because the side web of the step will get in the way otherwise.)

Now see that the step is straight in line with the line of rivets, and use the hole at the other end of the step to jig-drill the tender side. Insert and head the rivet, then drill the other six holes right through and insert the six rivets.

With the lower footstep, the central rivet is inserted first, and then the two outer ones, but see that it comes parallel with the first step!

Both steps may now be sweated to the side by use of a hot soldering-bit.

(To be continued)

Queries and Replies

Enquiries from readers, either on technical matters connected with model engineering, or referring to supplies or trade services, are dealt with in this department. Each letter must be accompanied by a stamped, addressed envelope, and addressed: "Queries Dept.," THE MODEL ENGINEER, 23, Great Queen Street, London, W.C.2.

Queries of a practical character, within the scope of this journal, and capable of being dealt with in a brief reply, will be answered free of charge

More involved technical queries, requiring special investigation or research, will be dealt with according to their general interest to readers, possibly by a short explanatory article in an early issue. In some cases the letters may be published, inviting the assistance of other readers.

Where the technical information required involves the services of an outside specialist or consultant, a fee may be charged depending upon the time and trouble involved. The amount estimated will be quoted before dealing with the query.

Only one general subject can be dealt with in a single query; but subdivision of its details into not more than five separate questions is permissible. In no case can purely hypothetical queries, such as examination questions, be considered as within the scope of this service.

No. 9933.—Rewinding Motor
E.S. (Swindon)

Q.—I shall be grateful if you will advise me regarding the rewinding of a small motor. This was originally a motor/generator (*ex*-Govt.), 12 V-450 V. The armature had been burned out and the motor stripped. I wish to rewind for 230 V a.c. Two field coils are in order in their original state. Would you advise me on rewinding these also. The details of the armature are as follows :—13 slots 9/32 in. × $\frac{3}{8}$ in. × $\frac{1}{8}$ in. with $\frac{1}{8}$ in. opening, $1\frac{3}{4}$ in. dia. × $2\frac{1}{2}$ in. long. Two commutators fitted (one each end) 26 and 52 segments. Which would you advise using? The field frame is laminated and round, and can be set in any position relative to the pole-pieces. At the moment, the brushes are at 90 deg. The pole-pieces are slightly over $1\frac{1}{2}$ in. × $2\frac{1}{2}$ in.

R.—Your motor should be wound as follows :—The armature will have 13 coils, each of two section. The wire size will be 36 s.w.g. enamel single silk-covered copper wire. The slot span is 1 and 7 and the connections to commutator bars 1 and 2. Slot insulation may be to 10 mil. thickness of combined Leatheroid and Empire cloth; the Leatheroid should be next to the iron. The turns per section will be 46, one coil having 92 turns. Commence winding in slots 1 and 7, wind on 46 turns; this comprises one section. Without cutting the wire, bring out a loop and continue to wind on another 46 turns. This completes one coil. Without cutting the wire, continue in slots 2 and 8, winding on another 46 turns and so on until the number of coils are in place. Each loop goes down to a commutator bar, and the starting and finishing ends of the winding join together to form a loop. The slot insulation is closed down into the slots and wedges should be pushed through the slots. The wedges can be a suitable thickness of Presphan.

The field coils may be wound in 34 s.w.g. plain enamel covered copper wire. The turns per coil may be 350-400 turns, and two laps of thin cotton tape are suitable for taping these coils. A Leatheroid liner should be put in the field slots to protect the coils. Any hard-baking armature varnish is suitable for both windings.

No. 9934.—An Old Fuller Electric Motor
L.R. (Edmonton)

Q.—I have a very old-type Fuller ½ h.p., a.c., 240 V, single-phase motor, with no automatic starting gear. It has four terminals on the wiring plug, two starter and two running. I have used a double-pole change-over switch wired as follows: The main current is run to the starter wiring, this revolves the motor, then I throw the switch and convert the main current on to the running wiring. It then runs successfully. The snag is that I can only do this when the motor is running without load. If tried with load, I just blow the fuses, but if I pull the belt round by hand to give it a start and put the switch on the running position, it works quite well. This is neither a safe nor satisfactory method, so I would be greatly obliged if you could give me some information for improving the work under load. Would the installation of a condenser be of any help, and if so could you give me the wiring details?

R.—As your motor has four terminals, the starting is carried out as follows:—Both windings are connected in parallel to the supply during starting, and after the motor has run up speed, the starting winding is disconnected and the motor then runs on the running winding alone. A special type of switch is necessary for this switching. It is one having two knobs, both of which are pressed down together. Removing the finger from the switch knobs, one knob returns to the "off" position; this is the starting knob of the switch. The switch is manufactured by Messrs. Lundberg & Sons, Liverpool Road, Holloway, London, N.7. The use of a condenser in the starting winding would, of course, improve the starting torque, but a value for this cannot be satisfactorily arrived at unless the inductance of the winding is known. Also, a condenser for a motor of this size would be expensive because it is of a special type.

No. 9938.—Motor Winding
R.H.R. (Haslemere)

Q.—Will you please let me know suitable windings for a small motor to run on 12 V at current consumption less than 1 A if possible. Tripole armature ½ in. dia. × ½ in. long, winding space for field bobbin 17/32 in. long, ½ in. dia. with $\frac{3}{16}$ in. bore.

R.—A winding that should suit your motor would be as follows:—The armature may have 60-70 turns per pole of No. 34 s.w.g. enamel single silk-covered copper wire. Having wound one pole, do not cut the wire, but bring out a loop and continue winding on the next pole, continue in this way until all coils are in place. The finishing end of the last coil put on connects to the starting end of the first coil. Each loop goes down to one commutator bar. The field coils may be wound with No. 32 plain enamel covered copper wire, the turns per coil being 150-200, or as much as can be got in the available winding space. If the armature turns remain constant, any variation of the number of turns of the field coils will vary the speed of the motor; the greater the turns the lower the speed for a given voltage. Ordinary shellac varnish is suitable for this low voltage. The motor should be baked at a low temperature after winding. This winding is for a series motor, that is, the field and armature are connected in series with each other.

No. 9936.—Constant-voltage Transformer
H.L.S. (Doncaster)

Q.—What is the principle on which a constant-voltage transformer works? Small transformers are used to supply a low voltage light source in photo-electric colorimeters from the ordinary mains supply. Over what range of mains voltage (input) fluctuation would a constant-voltage transformer give a steady 12 V output?

R.—The constant-voltage transformer is one in which the magnetic leakage is kept to the smallest value; this is carried out by the winding arrangement. The windings can be concentric; in other cases, the windings are distributed over the core by dividing the respective winding in sections sandwiched together. The normal transformer of good design is a constant-voltage transformer, and this means that it will give practically a constant voltage over the range of its current output. No transformer can quite provide a constant voltage on the output side if the input voltage varies. As the primary and secondary turns bear a ratio to each other, any variation of the input voltage will give a variation of the output voltage.

No. 9931.—Welding Generator
E.J.W. (Neath)

Q.—I have the chance of a d.c. generator coupled to a three-phase 6 h.p. motor. The generator bears the following data: V—60, Revs—1,450, Amp.—60, Wound—compound. Would this generator be suitable for use as a welding plant?

R.—Generators for welding are special machines: they are designed to have what is known as a "drooping" characteristic. At striking the arc, the voltage is much higher than that required for the actual welding. The generator voltage would require to be in the region of 100 V on open circuit, and the voltage would adjust itself to the arc requirements once the arc were struck. In the ordinary way and using an ordinary generator, this reduction of voltage would have to be carried out by hand by the use of a shunt regulator. The drooping effect is produced by compounding the generator in a certain manner, and the series compound field is arranged so that the main field is weakened as the arc load comes on, and is automatic. Sixty A, in any case, would not be of much use as a welding current, except for very thin work. Currents in the region of 80-100 A would be necessary for small general work.

PRACTICAL LETTERS

A Model Triple Expansion Steam Engine

DEAR SIR,—The two photographs illustrate a model triple expansion marine engine on which I have been working for three years in leisure time and have now almost completed. The size of it is indicated by the penny which has been photographed alongside. The angular spacing of the three cranks is arranged so that very good balance is obtained. A piston valve is fitted to the h.p. cylinder and two balanced slide-valves of the "matchbox" type of the i.p. and l.p. cylinders. The crankshaft is turned from the solid, including integral eccentric sheaves, and took two weeks' work, four hours per day, to complete. Owing to the small size of the components, castings could not be obtained and these, including the cylinders, were fabricated by silver-soldering with Easiflow. The smallest bolts are 14 B.A.; these are used in the valve-gear which is of the Stephenson link type. It is possible to link up the valves independently, up to 75 per cent. This engine runs quite well at pressures varying from 7 to 85 lb. p.s.i. and will tick over at 60 r.p.m. with a 3 in. diameter coarse-pitch propeller fully immersed at 15 lb. p.s.i. Normal working speed is 245 r.p.m. Most of the material was obtained from advertisements in THE MODEL ENGINEER.

I am now making a 2½-in. gauge model of the W. Dean G.W.R. locomotive *Gooch*

Yours faithfully,

London. C. A. BURTON.

Electronic Organs

DEAR SIR,—In reply to Mr. Siddons' letter in the February 7th issue of THE MODEL ENGINEER, I would like to draw his attention to the book, *The Electronic Musical Instrument Manual*, by Alan Douglas, published by Pitman.

Although a little expensive, it is really valuable for anyone wishing to know all about the different systems in use, as it gives mechanical details and circuits of several commercial intruments.

I would, however, advise Mr. Siddons to beware of photo-electric methods, as they have some rather serious drawbacks to amateur construction; apart from the fact that the output of a photo-cell generator is small, when compared with that of an electromagnetic generator of comparable size.

Yours faithfully,

Gloucester. J. P. CECIL

Mr. Burton's triple expansion marine engine

Below—Reverse side view of engine